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# XII

# EXPEDITION TO GUADALUPE ISLAND, MEXICO, IN 1922

## GENERAL REPORT

BY

G. DALLAS HANNA

*Curator, Department of Paleontology*

### INTRODUCTION

At the Berkeley meeting of the Pacific Division of the American Association for the Advancement of Science in 1921 there was appointed a "Committee on the Conservation of Marine Life of the Pacific," Dr. Barton Warren Evermann, Chairman.[1] The first task which the Committee undertook

[1] The full membership of the committee was as follows when the expedition was organized:

DR. BARTON WARREN EVERMANN, *Chairman*, California Academy of Sciences, San Francisco, Calif.
DR. G. DALLAS HANNA, *Secretary*, California Academy of Sciences, San Francisco, Calif.
W. E. ALLEN, Scripps Institution for Biological Research, La Jolla, Calif.
A. W. ANTHONY, Museum, San Diego Society of Natural History, San Diego, Calif.
PROFESSOR WM. A. BRYAN, Museum of History, Science and Art, Los Angeles, Calif.
DR. HAROLD C. BRYANT, Museum of Vertebrate Zoology, Berkeley, Calif.
PROFESSOR JOHN N. COBB, College of Fisheries, University of Washington, Seattle, Wash.
CAPT. W. C. CRANDALL, Scripps Institution for Biological Research, La Jolla, Calif.
DR. C. MCLEAN FRASER, University of British Columbia, Vancouver, B. C.
DR. HAROLD HEATH, Stanford University, Calif.
DR. WM. E. RITTER, Scripps Institution for Biological Research, La Jolla, Calif.
NORMAN B. SCOFIELD, California Fish and Game Commission, San Francisco, Calif.
ALVIN SEALE, Steinhart Aquarium of the California Academy of Sciences, San Francisco, Calif.
PROFESSOR EDWIN C. STARKS, Stanford University, Calif.
DR. F. B. SUMNER, Scripps Institution for Biological Research, La Jolla, Calif.
DR. WALTER P. TAYLOR, U. S. Bureau of Biological Survey, care Scripps Institution for Biological Research, La Jolla, Calif.
WILL F. THOMPSON, California Fish and Game Commission, San Pedro, Calif.

was the making of recommendations to the proper authorities for the conservation of certain of the marine mammals of that ocean. In the case of a few species, such as the Alaska fur seal, there existed sufficient authoritative information in governmental reports to enable the advocation of certain measures which, it was believed, would aid materially in bringing them back to their former abundance and commercial importance.

But with other species practically nothing was known of their present status or condition; indeed, the very existence of some of them was in doubt. The Committee at once proceeded to devise means whereby this deficiency could be filled in order that definite facts might be available for it to use in urging measures of protection. This absence of late information was notably true in respect to the Guadalupe elephant seal, Guadalupe fur seal and southern sea otter, all of which once existed in great abundance along the shores of California and Lower California. The latest data in respect to them had been secured many years ago and was not sufficiently recent, it appeared, to warrant an active campaign for the preservation of the species.

Therefore, through the activities of the Committee, an expedition was dispatched from San Diego, California, on July 9, 1922, to the islands off the west coast of Lower California for the primary purpose of securing information in regard to the three above-mentioned species of sea mammals. The following institutions actively cooperated in the enterprise:

National Government of Mexico,
California Academy of Sciences,
San Diego Society of Natural History,
Scripps Institution for Biological Research,
National Geographic Society.

The Government of Mexico provided the Fisheries Patrol Boat *Tecate* for the work and met all expenses while the party was in the field; and that country was represented by the following official personnel: Professor Carlos Cuesta-Terron, Curator of Fishes and Reptiles of the National Museum of Mexico, in charge of the expedition; Professor José M. Gallegos. Explorer of the National Museum of Mexico; Sr.

Joaquin Palacios, Inspector of Lighthouses; Sr. Rudolpho Lascano, Assistant Inspector of Lighthouses; Sr. Enrique Gonzales, Inspector of Fisheries; and Sr. Luis Rubio, Taxidermist.

The Committee was represented by the writer (Secretary) and Mr. A. W. Anthony. They also represented the California Academy of Sciences and the San Diego Society of Natural History, respectively, and were placed in charge of the scientific work of the expedition. Advantage was taken of this exceptional opportunity to secure scientific data in other branches of natural history in this little known and seldom visited region. Mr. Joseph R. Slevin, Assistant Curator, Department of Herpetology, and Mr. Frank Tose, Chief Taxidermist, accompanied the expedition from the California Academy of Sciences. Mr. Ernest Hinkley went from the San Diego Society of Natural History. The Scripps Institution for Biological Research, being actively engaged in oceanographic studies of broad scope, sent Mr. P. S. Barnhart for the systematic collection of water and plankton samples and ocean temperatures.

The motor ship *Tecate* was admirably suited to the work in hand and the success of the expedition was in no small measure due to the constant interest of Captain Victor Angulo and his well trained crew. Everything possible was done to aid the observers and collectors during the five weeks in the field. (See pl. 15, fig. 1.)

The expedition returned to San Diego on August 16 after having visited the following desert islands: Guadalupe, San Martin, Cedros, the three San Benitos, Natividad, San Roque, Asuncion, Magdalena, and Santa Margarita. Landings were also made at Ensenada, San Quintin Bay, San Bartolome Bay and Abreojos Point on the Peninsula of Lower California. Besides making observations and extensive collections of natural history specimens at all of these places, the coast line was studied at close range for considerable distances from the vesel, particularly around the long bight known as San Cristobal Bay where elephant seals are known to have once hauled out on the sands in abundance. Also a large number of samples of

animal and plant life of the open ocean (plankton) and temperature records were systematically collected.

Specimens were obtained in the various groups in approximately the following numbers: birds and mammals, 300; reptiles and amphibians, 1000; insects, 1100; land shells, 2000; marine fossils, many; and miscellaneous fishes, invertebrates, and plants. These have all been submitted to specialists and the technical reports upon them will be published in due time. It is already known that numerous strange and rare forms of animal life are represented in the collections, many of them being entirely new to science. Readers interested in the subjects are referred to these final reports for complete and technical information. In the following pages an attempt has been made to give the most interesting features of these desert isles and the general results of our search for the fur seals, elephant seals and sea otters.

## Organization

The organization of the expedition was largely the result of the activities of Dr. Barton Warren Evermann and Mr. A. W. Anthony, Directors of the California Academy of Sciences and the San Diego Society of Natural History, respectively. Through them the cooperation of the National Government of Mexico was obtained and the success of the undertaking was assured. It was understood informally that Sr. Ing. Ignacio Romero, Agente General de la Secretaria de Agricultura y Fomento, Tijuana, B. C., was an enthusiastic supporter of the enterprise from the start and aided in many ways in arranging the details necessary for the despatch of the *Tecate* and party.

The following general memorandum was prepared before departure of the expedition and was distributed for guidance in the work proposed.

"1. *Designation.*—The expedition will be known as the Expedition of the Committee on Conservation of Marine Life of the Pacific of the Pacific Division of the American Association for the Advancement of Science functioning under authority of the Committee on Pacific Investigations of the Division of Foreign Relations of the National Research

Council, and conducted under the patronage of the Mexican Government, the California Academy of Sciences, the Scripps Institution for Biological Research, the San Diego Society of Natural History, and the National Geographic Society.

2. *Personnel.*—The expedition will be made on the Fisheries Patrol Vessel *Tecate* which the Mexican government has generously detailed for the purpose, and will be under the general direction and supervision of Señor Carlos Cuesta-Terron of the National Museum of Mexico, who will have associated with him a number of scientific gentlemen of his country.

[American members of the scientific staff were then listed. See p. 217.]

The scientific investigations will be under the immediate direction of Messrs. Hanna and Anthony.

3. *Field of operations.*—Islands and their surrounding waters off the west coast of Lower California, particularly the islands of Guadalupe, San Benito, Cedros, and Natividad; also Magdalena Bay and other points on the mainland.

4. *Purpose.*—The primary purpose of the expedition is to make investigations to determine as fully as may be the present abundance and condition of the southern fur seal, southern sea otter, and elephant seal in the localities visited.

It is known that each of those three important and valuable marine mammals was at one time quite common not only about the islands mentioned but also about the islands on the California coast as far north as the Farallons. Records believed trustworthy show that in the years 1808 to 1811, more than 203,000 fur seals were taken on the Farallon Islands, besides many thousands on the Channel Islands, Cedros and other islands off the coast of Lower California. Records also show that the southern sea otter was at one time very abundant in the great kelp beds about these same islands, more than 22,000 having been taken prior to 1806. The elephant seal was once abundant on Guadalupe Island and on other islands on this coast.

It is generally believed that each of these interesting animals is now extinct or nearly so; but certain recent discoveries indicate that at least small remnants of each of the three species still exist. It is the purpose of this expedition to find out the facts in-so-far as is possible and place them before the State Departments of the United States and Mexican governments in the hope that the necessary steps may be taken by the two governments through an international treaty for the adequate protection of these valuable natural resources.

5. *Other scientific investigations.*—The scientists of this expedition will avail themselves of the exceptional opportunities for making a general survey of the fauna and flora and geology of the islands visited. They will be equipped for making collections in various branches of nat-

ural history, particularly of birds, mammals, insects, shells, botany, and fossils. These islands have been but little explored and it is believed that many new species will be discovered. Provision is made for taking photographs, both still and moving, adequate for illustrative and educational purposes."

(Signed) Barton Warren Evermann
*Director of the Museum of the California Academy of Sciences, and Chairman of the Committee on Conservation of Marine Life of the Pacific.*

(Signed) G. Dallas Hanna
*Secretary of the Committee on Conservation of Marine Life of the Pacific.*

The National Geographic Society through its President, Dr. Gilbert H. Grosvenor, contributed the sum of $500.00 to aid in defraying the expenses of the expedition. This was used for photographic purposes with the understanding that prints from all official still-camera pictures should be furnished to the Society accompanying an article suitable for publication in its magazine.[2]

Of 360 exposures made with a 4x5 camera, 314 negatives were obtained, suitable for illustrative purposes. Prints of these were furnished to the National Geographic Society; the San Diego Society of Natural History; the National Government of Mexico; the California Academy of Sciences; and various members of the party. The negatives have been deposited in the latter institution. In addition to the above, several members of the party took photographs, prints of which were furnished to the Academy. About 800 feet of motion picture negative was made of the herd of elephant seals on Guadalupe Island. This has been deposited in the Academy and prints were furnished to the National Government of Mexico and the San Diego Society of Natural History.

Upon the completion of technical reports of the scientific collections obtained it was understood that an equitable division of specimens would be made among the institutions represented.

In addition to the account of the expedition published by the National Geographic Society, announcements giving major

[2] See—A Cruise among Desert Islands, by G. Dallas Hanna and A. W. Anthony. Nat. Geog. Mag., Vol. 44, No. 1, July, 1923, pp. 70-99, 33 photographs. (Various portions of this article were widely quoted as for instance: Illustrated London News, Sept. 29, 1923, Vol. 163, No. 4406, pp. 564-565, 9 photographs.—Literary Digest, Vol. 79, No. 8, Nov. 24, 1923, pp. 50-52.)

facts appeared in *Science* and other publications before departure and after returning.[3]

ITINERARY

| Date | Arrived | Place | Departed | Region Visited |
|---|---|---|---|---|
| July 9 | ..... | San Diego..... | 9.00 AM | ..... |
| 9 | 5.00 PM | Ensenada..... | ..... | ..... |
| 10 | ..... | Ensenada..... | 3.00 PM | ..... |
| 11 | 2.00 PM | Guadalupe Island..... | ..... | ..... |
| 12 | ..... | Guadalupe Island.... | ..... | Elephant Beach |
| 13 | ..... | Guadalupe Island.... | ..... | Cypress Grove and South side |
| 14 | ..... | Guadalupe Island.... | ..... | Esparsa Cañon |
| 15 | ..... | Guadalupe Island.... | ..... | Pine Ridge |
| 16 | ..... | Guadalupe Island.... | ..... | Jack's Bay and south end |
| 17 | ..... | Guadalupe Island.... | 5.30 PM | South end; east side |
| 18 | 2.00 PM | San Quintin Bay..... | ..... | ..... |
| 19 | ..... | San Quintin Bay..... | ..... | Santo Domingo |
| 20 | ..... | San Quintin Bay..... | ..... | ..... |
| 21 | ..... | San Quintin Bay..... | 4.00 PM | ..... |
| 22 | 10.00 AM | Cedros Island..... | ..... | Bernstein's Abalone Camp |
| 23 | ..... | Cedros Island..... | 7.00 AM | Bernstein's Abalone Camp |
| 24 | 9.30 PM | Magdalena Bay..... | ..... | Village |
| 25 | ..... | Magdalena Bay..... | ..... | ..... |
| 26 | ..... | Magdalena Bay..... | ..... | ..... |
| 27 | ..... | Magdalena Bay..... | Noon | ..... |
| 27 | 3.00 PM | Santa Margarita Island | ..... | Village |
| 28 | ..... | Santa Margarita Island | ..... | Cactus Forest |
| 29 | ..... | Santa Margarita Island | ..... | Rancheria |
| 30 | ..... | Santa Margarita Island | 9.00 AM | Village |
| 31 | 1.00 PM | Abreojos Point..... | ..... | ..... |
| Aug. 1 | ..... | Abreojos Point..... | 6.00 AM | ..... |
| 1 | 11.00 AM | Asuncion Island..... | ..... | ..... |
| 2 | ..... | Asuncion Island..... | 6.00 AM | ..... |
| 2 | 7.30 AM | San Roque Island.... | ..... | ..... |
| 2 | ..... | San Roque Island.... | 11.00 AM | ..... |
| 2 | 6.00 PM | San Bartolome Bay... | ..... | North part |
| 3 | ..... | San Bartolome Bay... | 6.30 AM | ..... |
| 3 | 9.00 AM | Natividad Island..... | ..... | ..... |
| 4 | ..... | Natividad Island..... | 6.30 AM | ..... |
| 4 | 9.00 AM | Cedros Island..... | ..... | Bernstein's Abalone Camp |
| 5 | ..... | Cedros Island..... | ..... | Bernstein's Abalone Camp |
| 6 | ..... | Cedros Island..... | ..... | Bernstein's Abalone Camp |
| 7 | 6.00 AM | Cedros Island..... | ..... | Grand Cañon |

[3] Evermann, Barton W. (Catalina Islander, Vol. 9, No. 28, pp. 1, 10, July 26, 1922.)
Evermann, Barton W. (Sports Afield, Vol. 69, No. 2, pp. 102-103, August, 1922.)
Evermann, Barton W. (Science, n. s. Vol. 56, No. 1440, pp. 135-137, August 4, 1922.)
Evermann, Barton W. (Pacific Fisherman, Vol. 20, No. 8, p. 16, August, 1922.)
Hanna, G. Dallas. (San Diego Union, Thursday, August 17, 1922.)
Hanna, G. Dallas. (Golden Gate Pathfinder, Vol. 3, No. 34, p. 2, August 27, 1922.)
Hanna, G. Dallas. (Golden Gate Pathfinder, Vol. 3, No. 38, p. 2, Sept. 24, 1922.)
Hanna, G. Dallas. (Golden Gate Pathfinder, Vol. 3, No. 40, p. 2, October 8, 1922.)
Hanna, G. Dallas. (Catalina Islander, Vol. 9, No. 37, pp. 6-7, September 27, 1922.)
Hanna, G. Dallas. (Science, n. s. Vol. 51, No. 1453, pp. 503-504, November 3, 1922.)
Evermann, Barton W. (Proc. Calif. Acad. Sci., 4th Ser., Vol. 11, pp. 665-667, August 22, 1923.)

| DATE | ARRIVED | PLACE | DEPARTED | REGION VISITED |
|---|---|---|---|---|
| Aug. 8 | 1.00 AM | Cedros Island..... | ..... | North end |
| 10 | 10.00 AM | Cedros Island..... | ..... | Bernstein's Abalone Camp |
| 10 | ..... | Cedros Island..... | 3.00 PM | Bernstein's Abalone Camp |
| 11 | 7.00 AM | Cedros Island..... | ..... | Abalone camp on west side |
| 12 | ..... | Cedros Island..... | 7.00 AM | ..... |
| 12 | 9.30 AM | West Benito Island... | ..... | ..... |
| 13 | ..... | West Benito Island... | 8.30 AM | Middle Benito also |
| 13 | 9.00 AM | East Benito Island.... | ..... | ..... |
| 13 | ..... | East Benito Island.... | 2.00 PM | ..... |
| 14 | Noon | San Quintin Bay..... | ..... | ..... |
| 14 | ..... | San Quintin Bay..... | 2.30 PM | ..... |
| 14 | 5.30 PM | San Martin Island.... | ..... | ..... |
| 14 | ..... | San Martin Island.... | 7.00 PM | ..... |
| 15 | 9.00 AM | Ensenada..... | ..... | ..... |
| 15 | ..... | Ensenada..... | 11.30 AM | ..... |
| 16 | 9.00 AM | San Diego..... | ..... | ..... |


Fig. 1. A sketch map showing the region visited by the expedition of 1922; drawn by James M. Darley; from National Geographic Magazine, July, 1923.

The region covered in the above itinerary is included in the following series of sailing charts of the Hydrographic Office of the U. S. Navy;[4] it is therefore not believed necessary to reproduce a general map of the area other than the sketch shown above.

| *Area covered* | *Chart number* |
|---|---|
| General, West Mexico | 1006 |
| San Diego to San Quintin Bay | 1149 |
| San Quintin Bay to Cedros Island | 1193 |
| Cedros Island to Abreojos Point | 1310 |
| Abreojos Point to Cape San Lazaro | 1493 |
| Cape San Lazaro to Cape San Lucas | 1664 |
| Cape San Lazaro to Cape San Lucas | 621 |
| Todos Santos Bay | 1046 |
| Guadalupe Island | 1681 |
| Hassler Cove | 1686 |
| San Quintin Bay | 1043 |
| Cedros Island | 1192 |
| San Benito Islands | 1194 |
| San Bartolome Bay | 1204 |
| San Ignacio Lagoon | 1492 |
| San Roque and Asuncion Islands | 1268 |
| Magdalena Bay | 1636 |

The night before the Expedition left, the members gathered around a dinner table at La Jolla and listened to an exposition of its aims and objects given by various persons directly interested in it. Informal talks were given by Dr. Barton Warren Evermann, Sr. José M. Gallegos, Dr. Fred Baker and others.

Next morning, July 9, at nine the lines of the *Tecate* were cast off at San Diego and Ensenada was reached at five the same day. The Mexican officials were hosts at a dinner given to the rest of us that evening. At three p. m. of the tenth the last of the stores had been taken aboard and the ship was headed toward Guadalupe Island, 170 miles to the southwest.

Off Point Banda there are 10 rocks, white from the occupancy of them by various birds, chiefly brown pelicans, Brandt's cormorants and western gulls. Eight of these rocks were occupied by California sea lions, the total number being estimated

[4] See, "Mexico and Central America Pilot (West Coast)," Hydrographic Office, U. S. Navy, Publication No. 84, 6th Edition, 1920, and Supplement to same issued in 1923. In each of these there is an index map of the area covered; on this map all of the charts issued by the office are indicated.

at 250. Close watch was kept for sea otters and fur seals in the kelp beds as the *Tecate* passed close inshore here but, as was to be expected, none was seen. Formerly both species lived at this point in great abundance and it is not so many years ago that 30 sea otters were killed; this was the last time a large number was slaughtered. Since then the species has been practically extinct and in a region where a century and a half before thousands were killed in a single season.

Before darkness closed in about the little motorship, two red phalaropes were seen feeding on the sea. They were in full fall plumage and it seems incredible that they had been to the breeding grounds in northern Alaska and had returned this far south already on the fall migration. They must surely have remained behind the great flocks which annually follow the American coast to the Arctic regions.

On the 11th, at ten a. m., Mr. Slevin, with eyes trained to the sea, announced Guadalupe Island in sight. Two hours later, between banks of fog, the ruggedness of the black scorched cliffs of the north end was in plain sight and at three p. m. we landed at the place called "Northeast Anchorage."

A settlement had formerly been at this place; sometimes it consisted of soldiers and their families; again the occupants were those trying to successfully exploit the goats of the island. At this time the place was not inhabited but one of the sheds almost filled with dried meat and skins indicated that people had occupied the place not more than one or two years previously. The best of the buildings was a two story adobe house used by officers of the military party; it was painted white.[5]

On the trip across from Ensenada, Mr. Barnhart and I alternated taking samples of water from the surface of the sea. These water samples were collected by tying a small bottle to the bottom of a silk net. Three full buckets of known capacity were poured into the net, the plankton collecting in the bottle. The minute animal and plant life was killed and preserved with formalin, a label was added and the sample packed away for use of Dr. W. E. Allen in oceanographic study. These samples were taken every hour during the cruise, when the vessel was under way.

[5] See fig. Nat. Geog. Mag., Vol. 44, No. 1, p. 72, July, 1923.

While camp was being established on shore, Mr. Slevin and I walked up the cañon back of the buildings about a mile. The country is excessively rough and shows evidences of volcanism on a grandiose and awe-inspiring scale on every side. Huge caves and caverns festooned with ragged lava line the cliffs on both sides of the cañon. In some places strata of scoria, cinders and loose rocks are bedded as if they might have fallen in water from a spouting volcano. Subsequent to deposition the beds were violently disturbed because it is not unusual to see the dip of the strata change 90° in 100 yards. No fossils of any kind were found so it cannot be certain that any of the material was laid down in the sea.

The cañon showed evidence of considerable water at a not very distant date. Large water holes, lined with fresh sediment were in the bed of the stream but not a spot now appeared to be moist. All of the vegetation in that vicinity was likewise dry except the poppies and one or two other kinds of plants. Wild oats, waist high, grew in profusion where there was soil. Goats were excessively abundant everywhere and were well fed. Doubtless there had been sufficient rain in earlier months to produce plenty of pasturage. But the dried bleached bones strewn over the ground in greatest profusion showed that famine had spread over the herd in other years and had taken enormous toll. Probably, as in most of Lower California and the outlying islands, rain is scant and very irregular on Guadalupe. Certainly the greatest part of the island is a desert of the most barren sort.

No cats were seen during the brief sojourn in the cañon that evening and during the rest of our stay on the island they successfully evaded us. Several skulls were collected at various places. Mr. Hinkley took one from a well (salty) at the landing place. Another was later found at the extreme south end of the island showing that this pest has completely overrun the place. Escaping as pets or abandoned by former occupants, this animal has reverted to the wild state and has wreaked havoc among the birds. We saw evidence of this everywhere we went. The Kaeding's petrels were apparently preyed upon the most. The action of the cats could be plainly read from the record on the ground. The petrels live among the loose

rocks and in the holes of the cliffs, where the cats apparently have no difficulty in capturing them as they go and come. Many were seen with only the top of the head eaten away.

In this cañon we took five species of land snails: two Pupillidæ; two Micrarionta and the strange *Binneya notabilis* found elsewhere only on Santa Barbara Island, off southern California. Here on Guadalupe it is very abundant and appears to be identical in every way with those of the northern island. It is about halfway between a true snail and a slug. Many of the snail shells had been broken and the soft parts extracted by mice.

The house mouse is apparently very abundant all over the island; specimens were collected which do not differ from individuals of other lands. The species probably came accidentally with personal baggage, has increased enormously, and probably will completely exterminate the land shell fauna. Probably numerous species of insects have already disappeared through this agency. The cats, of course, will not eat the mice as long as they can subsist on birds.

Mr. Slevin looked carefully for lizards on many parts of the island but failed to find a single one. Prof. Cuesta-Terron stated that he had a report of a specimen having the characters of a Xantusia but it was not sufficiently reliable to be credited without supporting evidence. Mr. Slevin's failure to find a species of reptile of any kind naturally leads us to believe none lives there.

Late in the evening of July 11 an osprey was shot at the landing place; this species had not previously been reported from Guadalupe Island.

On the morning of July 12, with all hands on board the ship sailed around the north end of the island to the elephant seal rookery. On the way around, the beach was scanned at close range for Guadalupe fur seals but none was seen. Only in one place, a cave three-fourths of a mile north of the elephant seal rookery, did there appear to be any suitable ground where the fur seal might be expected. This was occupied by a few of the elephant seals.

The landing was made early in the forenoon at the northwest end of a short beach composed of black sand and on which

the elephant seals were located. Immediately back, huge, unscalable, lava cliffs rose to an elevation of 2000 feet. It was with much misgiving that we rowed in as quietly as possible, each moment expecting the animals to catch our scent or the noise of the oars and desert the place for the rest of the day. That invariably would have been the procedure if we had been approaching any of the northern rookeries of hair seals or sea lions I had visited. But they let the first boat load of us land without troubling themselves at all; the nearest ones, however, were some 50 yards away.[6] (See pl. 16, fig. 1.)

With motion picture equipment and Graflex camera we climbed a spur at the west end of the rookery and proceeded to take a series of pictures as rapidly as possible. Each turn of the crank and each snap of the camera I expected to be my last opportunity, but the lazy animals slept on. Other visitors coming ashore hid under a low cliff until the photography from the distance was finished. Some of them were then asked to walk slowly toward the herd. It was expected that a motion picture of them all rushing into the sea would prove an item of interest. Every one was equally surprised when the men walked right out among the huge beasts, slapping an occasional one on the back as a sign of greeting.

A count of the herd was made from this high point before the men went among the animals but it was subsequently discarded when it was found that a much more accurate census could be obtained from enlargements of some of the photographs. We thus determined the number present to be 264.

All of those present were males except one female. She was timid and left the beach soon after we arrived. It was noted that the long pendant snout of the male was represented in the female by a short and scarcely noticeable elongation. I do not believe the female can inflate her "trunk" as does the male and thus produce a resonance chamber or sound box to accentuate the ponderous snore-like sound the latter frequently make.

There was one young seal on the beach, perhaps a yearling, and its silvery coat of hair fairly glistened in the sun. It likewise deserted us soon after we made our presence known.

[6] Anthony (Journal Mammalogy, Vol. 5, No. 3, Aug., 1924, pp. 145-152, pls. 17-20) has given an account of the elephant seal herd in 1922, 1923, and contributed other data of historical value.

On the beach, down among the animals we made many close-range studies and photographs. (See pl. 16, fig. 2.) This was shedding time[7] and we were all much surprised to see some animals with large flakes of epidermis peeling off of their bodies, bringing the old hair with it. Much of this cast-off skin littered the beach. The underside of the neck of the well grown male was very greatly creased and corrugated, and the color was brilliant geranium pink. Otherwise the coloration was a somber drab or gray, like the unspotted hair seals to which they are somewhat distantly related. The corrugations on the necks have been called scars from fighting, but they seem to be too regular and uniform. I think it is purely a sexual character of the species. The only fighting scars I saw were on the backs.

The animals were all excessively fat. On those occasions when we were able to get one to go into the water, wrinkles or waves of fat traveled the length of the body as it moved on the sand, undoubtedly aiding in the movement forward or backward. In coming from the water great deliberation was shown, advantage apparently being taken of the last ounce of "push" in the breaking surf. Locomotion was exceedingly slow and laborious on land; the diminutive front flippers are used to a certain extent to pull the huge bulk forward but they and the muscles which actuate them are entirely inadequate. The hind limbs project backward at all times and while they are very serviceable in swimming they serve no useful purpose on land.

One curious habit we noticed on land was the throwing of showers of sand up over and on the backs as they lay stretched out. The front flippers, one at a time are used for this and in some cases an animal looked like a huge pile of volcanic sand with flippers projecting at one end and nose at the other. Why this is done remained to us inexplicable when we left.

On several occasions we succeeded in causing a full grown bull to raise his head and shoulders to their full extent; then they are considerably taller than a man. The teasing to which they were subjected caused only the mildest sort of protest. This consisted only of throwing the head back high over the

[7] See figure in Nat. Geog. Mag., Vol. 44, No. 1, July, 1923, p. 77.

back and opening wide the mouth. On no occasion was an attempt made to bite one of us although ample opportunity was afforded had the animals been so disposed. How different were they in their docility from an equal number of fur seal bulls, which would have torn us literally to shreds under similar circumstances! On two or three occasions members of the party would place a hand on the back of an animal and vault over, rather than go around.

One of the strangest things to me about the elephant seals was the manner in which the snout (erroneously called trunk) was inflated, balloon-fashion, and allowed to dangle in the widely opened mouth when the head was thrown far back to utter the indescribably weird sound they make.[8] The noise (it can hardly be called a note), although of very low pitch, has peculiar carrying properties and the source is difficult to locate. So far as we could see the snout (about 12 inches long) was put to no other purpose. It can be of no value in the capture of food, else the young and females would likewise be thus provided.

The Mexican naturalists wished to obtain a specimen for their National Museum and this afforded an opportunity to investigate the food habits of the species. But the stomach was empty, except for some sand, and the natural food remains a mystery.

The breeding ground proper is at the southeast end of the beach and above high tide mark. Here were the remains of six dead animals, too far decomposed for careful examination. From them it was supposed that the ground had not been occupied probably later than March and perhaps earlier.

Many points in the life history of this strange beast remain unknown. For instance, where were the females and young? Certainly not around Guadalupe. It has been suggested that they migrate to the coast of Chile. This may be correct, but the animals seem ill adapted to so long a journey. Our observations indicated that they were not so adept in swimming as such species as the sea lions. They could hardly catch the incredibly swift pelagic fishes such as tuna, albacore, yellowtail, etc., which abound about Guadalupe. Moreover, there appeared

[8] See figure in National Geog. Magazine, Vol. 44, No. 1, July, 1923, p. 76.

to be no records of the species between Guadalupe and Chile. Truly this is an animal of mystery.

All of us were impressed with the apparent stupidity of the elephant seals. One man with a rifle could kill in a short time all of the herd then present. Years ago they were so butchered and the fat was rendered into oil. This continued to such an extent that the animal was supposed for a while to be extinct. It was very gratifying to us to see that there was at least a nucleus left to perpetuate the species and at least not yet will it follow the dodo and passenger pigeon into oblivion. After making due allowances for animals absent it would seem that the entire herd in 1922 must have contained not many fewer than 1,000[9] of all classes.

Upon our return to San Francisco the Committee under whose auspices the expedition was organized, took steps immediately to urge the Government of Mexico adequately to protect this relic of a bygone age of which it happened to be custodian. Our associates from that country took similar action and as a result on October 27, 1922, President Obregon issued the following proclamation declaring Guadalupe Island a reservation.

SUBJECT

Marginally a stamp which says:—United States of Mexico.—Presidency of the Republic.—Resolution of the Bureau of Agriculture and Public Works:

CONSIDERING

That the island of Guadalupe, of Lower California, and its territorial waters possess natural riches alike in forestry material and in herds, and in game and fish, numbering among its species many of rare occurrence, which species are in danger of extinction, owing to the immoderate exploitation of which they have been the object;

That the Federal Government must protect those species which constitute an inexhaustible fount of riches for the Government and the people of Mexico.

For that reason, I have considered it well to dictate the following

RESOLUTION.

Article 1.—The island of Guadalupe of Lower California, as well as the territorial waters surrounding it, remains reserved for the protection and

[9] Anthony (Journ. Mammalogy, Vol. 5, No. 3, Aug., 1924, p. 148) has stated that he believed 1250 total to be a conservative estimate of the herd in 1923, a year later.

development of the natural riches which they contain, alike in forestry material and in herds, and in game and fish.

Article 2.—There be named the technical and administrative personnel necessary for the administration and protection of the said riches.

Given in the residence of the Federal Executive Power, on the 19th day of the month of October of one thousand nine hundred and twenty-two.—THE CONSTITUTIONAL PRESIDENT OF THE UNITED STATES OF MEXICO.—A. OBREGON.—SEAL.—Published and executed.—THE UNDER SECRETARY OF AGRICULTURE AND PUBLIC WORKS COMMISSIONER OF THE BUREAU.—RAMON P. DE NEGRI.—Seal.

It is a copy which I certify agrees with the original.
MEXICO, October 27, 1922.
THE SECONDARY CHIEF CLERK.
GMO. S. SEGUIN.—Seal.

It is to be hoped that all loyal subjects of all civilized nations will respect this decree and permit the elephant seals to live their lives and perpetuate the species for the benefit of future generations of mankind.

After Mr. Tose had completed the making of the sketches he had in mind and had collected some accessory material, such as rocks, plants, dried elephant seal epidermis, etc., we sailed back to our shore camp. The articles mentioned were to be used for the preparation of a group of the mounted animals which the California Academy of Sciences had received several years previously and which was to be installed in the new Steinhart Aquarium, then under construction.

At the elephant seal beach, Mr. Anthony and others saw a wandering tattler fly listlessly from rock to rock in the most unconcerned and nonchalant manner. This bird has always been an enigma to me. I have seen it in summer on practically every north Pacific island I have visited from Guadalupe to the center of Bering Sea, and others have reported it as far south as the Revillagigedo group. Yet breeding records seem to be entirely wanting. It spends our winter months in the southern hemisphere and there is a possibility that its breeding ground is south of the equator.

On the way back from the elephant seal beach to our shore camp two yellowtail tuna were caught from the deck and proved to be a desirable addition to our already excellent bill of fare. The fishes were taken on a bone "gig" trolled far

behind the ship on a piano wire "leader" and very strong line. When a strike was made this powerful swimmer made the line fairly sing back and forth as it was hauled in, hand over hand. Such procedure would doubtless break the heart of a light tackle enthusiast but fishing for fun and fishing for food must always be separated.

That night as we were getting into our blankets at 10 o'clock under a starlit sky, we were greeted by a slight earthquake, lasting almost a minute—merely a gentle reminder of the immeasurable forces which have built this mountain peak from 12,000 feet beneath the waves to 4,000 feet above.

The next day, July 13, the party separated in order the better to cover more ground in our limited time. Messrs. Slevin, Gallegos, Barnhart and Hinkley, leaving in the early morning, took the trail up the cañon back of the buildings. After about six hours of steady, weary climbing, up the excessively rough lava slopes they eventually reached the forest of cypress trees near the top. Here Dr. Edward Palmer had camped in a veritable paradise in 1875. He found strange birds in abundance and a profusion of wild flowering plants.

No less than four species of the birds he found are now absolutely extinct and except for the museum specimens and his notes they are forever lost to humanity. There is some strange and lonely sadness that comes over us when we think of the last of a species of one of nature's creations having passed its span of existence. Paleontology tells us that hundreds of thousands of species have so passed on in times gone by; nevertheless, when we see one go we feel the loss the same as we do when a dear relative has received a last farewell.

The species of birds thus far exterminated on Guadalupe are: Guadalupe Caracara, Guadalupe Flicker, Guadalupe Towhee, and Guadalupe Wren.

The caracaras were abundant when Dr. Palmer was at the island but ten years later (1885), when Mr. Walter E. Bryant collected on Guadalupe for the California Academy of Sciences, he found them being killed by the soldiers stationed there "to protect the goats." It was evidently believed that the young kids were killed by the caracaras and, although the birds ranged from the sea shore to the highest peak, they were

soon all killed. The destruction was made easy because, it is said, the birds resorted to the water holes on top of the island to drink.

The other three lost species, the flicker, wren and towhee, have gone because they were unable to protect themselves from the house cats, running wild.

Our party saw no sign of any of these four species although special search was made for them. There was one other resident, the Guadalupe petrel, which we expected to find but did not. The last report of a naturalist previous to our visit (1906) stated that the birds were being rapidly killed by the cats. Our visit was too late in the season for us to say if all are gone or not.

In the vicinity of the spring near the cypress grove the party estimated the number of goats at 5,000. Naturally the water hole was in a foul and filthy condition. The animals have increased to a prodigious extent since they were first "planted."[10]

There are two stories told as to the early introduction of this pernicious pest on Guadalupe. One has it that the early whalers sailing from New England "planted" goats on all of the outlying and uninhabited islands in their track in order to provide a supply of fresh meat for their crews without the necessity of visiting a port where risk of desertion was always great. This version may be true, but when Dr. Palmer was on the island in 1875, the animals were there but had not increased sufficiently to cause any damage. In 1885 Green[11] stated there were many thousand.

The other version came to me after I returned to San Francisco. It was related to me by one John McCormick. One of the early whalers, Captain Breen, obtained a concession from the Mexican Government to raise goats on Guadalupe and introduced the nucleus of a herd there in 1872. This concession passed to Captain Breen's son who in turn willed a one-third interest to Felix Franquient and two-thirds to Sammy Solomon. Efforts to confirm this story were unsuccessful. Mr. McCormick told me he had reports that there were several million goats on the island and when informed that our party estimated the number at 40,000 to 60,000 his interest waned!

[10] See figure in Nat. Geog. Mag., Vol. 44, No. 1, July, 1923, p. 84, from photograph by J. M. Gallegos.

[11] Bulletin Calif. Acad. Sci., Vol. 1, Aug. 29, 1885, p. 215.

However the goats originally reached Guadalupe, they have increased enormously and through inbreeding have developed into a motley race colored white, red, brown, spotted, blotched, and black; curious malformations of horns have also resulted. They are at perfect ease on the tablelands of the top, on the perpendicular cliffs of the seashore or the steep-walled cavernous cañons. They were not very shy at the time of our visit. Two of them took up a station on the face of a vertical cliff close behind our camp and the ledge on which they had a footing was so narrow they apparently could not turn around to get back the way they went. Their bleating was somewhat annoying at times but finally one of them half jumped, half slid, to a talus slope 50 feet below. A safe landing was made and the goat trotted away as if that was an every-day occurrence. The cowboy propensities of one of our deck hands finally became irresistible and he lassoed the other animal and hauled it down.[12]

Several times we saw goats go deliberately to the sea and drink, and we were satisfied that this was practically the only method the majority of them have of quenching their thirst during the dry season. It is believed that many of them never visit the sources of freshwater on the island.

The party, while on the top of the island, collected a considerable supply of seeds of the Guadalupe cypress, a marvelously beautiful and graceful tree, entirely distinct from all other known cypresses. It is sometimes called "blue cypress" because of the blue-gray color of the foliage. For many years, the species was represented in California only by a few beautiful specimens on the grounds of the state capitol at Sacramento, two smaller ones in Golden Gate Park, San Francisco, and some others in Balboa Park, San Diego. None of these had ever produced seed. Therefore, Mr. John McLaren, Superintendent of Golden Gate Park, was very grateful for the supply of seeds brought back to him. A great many of them grew under the expert attention they received and may be expected to furnish shade to the children of the park long after the last one on Guadalupe has been "barked" and killed by the goats. Those who saw the grove there in 1922 stated that no small

[12] See figure in Nat. Geog. Mag., Vol. 44, No. 1, p. 82, July, 1923.

trees were found at all. The goats evidently eat every seedling which starts. In addition they had peeled the bark from many of the large trees to a point as high as they could reach.

The presence about the water hole on top of the island of a horse, six mules and 14 burros caused considerable astonishment to the party some of whom would have liked immensely to have received some assistance from these sturdy animals before they succeeded in negotiating the steep descent of the mountain. They reached camp, greatly fatigued, soon after dark.

Mr. Anthony and I rowed south from the landing, six or seven miles in order to make a careful search in the water and on land for fur seals but the quest was fruitless.

We landed at the first large cañon south of the buildings and spent two hours collecting on shore. Signs of house mice showed that these animals were excessively abundant. The rock slides were occupied by numerous Kaeding's petrels. These birds are chiefly nocturnal in their movements on land, and each night at our camp we heard them chattering among the rocks and cañons. Several were attracted to the lights on the ship and were captured easily. They are evidently not as expert on the wing as one would be led to expect by watching the birds gracefully skim the waves of the open sea; Mr. Slevin found two dried carcasses impinged on the thorns of the "cholla" cactus.

On July 14 Messrs. Anthony, Slevin, Terron, Barnhart, Tose and I rowed southward to a large cañon (Esparsa Cañon) which opens to the sea about three miles south of the Northeast Anchorage. The primary object was to secure seeds of the palm trees, about 1,000 of which grew above an elevation of 750 feet at this place. No ripe seeds were found and small trees which could possibly be transplanted were missing. Evidently not a new tree has started for a great many years, another blot against the goats. (See pl. 19, fig. 2.)

We succeeded in collecting a few other species of plants which the goats could not reach. Our method was to scale a cliff as far as possible and then shoot a fragment of the plant from its place of growth. Practically nothing edible for the goats could be reached by us; they are better cliff climbers

than we. Several things indicated that there might be fresh water underground in this cañon or as springs farther up.

The remainder of the party either worked in camp or in that vicinity during the day.

Early on the morning of July 15 Messrs. Terron, Anthony, Slevin, the engineer of the *Tecate* and I went to the top of the pine ridge, a knife-like promontory 2,500 to 4,000 feet high, on the northwest end of the island. We ascended from the first cañon north of the Northeast Anchorage and followed the crest of the ridge southeast about three miles.

Enormous, senile, wide spreading pines were very common on the top; some of them were beautiful specimens but many were dead or dying and a great many more had fallen. When we stopped on our southward march the pines were growing scarcer and the beautiful Guadalupe oak had appeared in considerable numbers.

Both of these trees are peculiar to Guadalupe and it is said there is not a living specimen of the oak elsewhere and very few pines. We were very anxious to secure acorns but systematic search failed to reveal a single one. We even climbed numerous trees in hopes of finding one lodged in a crotch or cavity but this failed. One botanist has stated that the acorns of this oak are the largest in existence so we were greatly disappointed in our failure.

With the pines we were more successful and a large supply of cones was brought back. As with the cypresses and palms, the goats have for many years effectually prevented any new growth and if some one does not succeed in transplanting the oak this beautiful species in a few more years will be forever lost.

The top of this ridge and a considerable distance down on the seaward side is bathed in almost constant fog. It was only between banks of this that we were able to get a glimpse, now and then, of the country round about and to take some pictures. The trees condense a great deal of moisture from these clouds and underneath many of them the ground was very moist.

Sr. Cuesta-Terron suggested that if Guadalupe could be made a government reservation it should be possible to fence

certain favorable forested areas of all the species of trees and thus keep the goats out. If this admirable idea can be carried out it no doubt will serve to perpetuate in their native habitat the five species which are otherwise doomed to certain extinction when the present generation of individuals is gone. These are the oak, pine, palm, cypress, and cedar.

We found none of the beautiful undergrowth of shrubs and succulent plants of this forest which was so fascinating to Dr. Palmer 50 years before. It is believed that about 100 native, endemic species of plants may have been entirely exterminated by the goats in this time.

We were greatly disappointed at finding no flickers, wrens or towhees. The dusky kinglet was also not seen although it had previously been found in the trees we visited. We did see about 15 individuals of the red-breasted nuthatch and many Guadalupe juncos. Guadalupe rock wrens and Guadalupe house finches were very abundant. Apparently these species had completed the rearing of young for the year and no eggs were found. Three red-tailed hawks were seen; this species is common on the island and was seen almost every day. A great blue heron was seen on shore.

Messrs. Tose and Hinkley worked closer to camp during the day and after the pine ridge party had returned the shore camp was broken and all hands went on board the *Tecate* for the night. Mr. Barnhart had spent the day studying the fishes about the shores near camp. Our facilities did not permit the preservation of an extensive collection of this interesting group, a fact which we regretted whenever we saw the intense blue *Azurina hirundo* over the kelp gardens. Mr. Anthony had helped to collect the type and two other specimens of this beautiful fish 25 years previously and they still remain the sole museum records of the species. We saw considerable numbers of them, but never many at one time; they persistently refused to take any bait we had to offer.

One of the most striking features of Guadalupe was the very unusual tameness of some of the birds. Rock wrens[13] were at almost every landing and juncos and finches were abundant among the trees. (See pl. 17, fig. 2.) All three species were most confiding and fearless in their behavior. If we sat down

[13] See figure in Nat. Geog. Mag., Vol. 44, No. 1, July, 1923, p. 73.

to eat a lunch and remained motionless for a few minutes, one or more of them would alight on our boots or hats. The strange part of it is that the cats have not as yet exterminated these species as well as some others.

This habit was in great contrast to all species on Cedros Island visited a few days later. There the birds, all species, were so wild and wary that it was almost impossible to collect specimens. I know of no explanation of these facts. Human beings visit one island as often as the other and probably never have the small birds been molested in either place other than by collectors.

The next morning, July 16, at eight o'clock, the ship got under way and sailed around the north end again to the elephant seal beach. The shore and caves were examined closely by rowing along just outside the surf line; we had high hopes of being as fortunate in our location of fur seals as we had been with elephant seals but there was no sign of the objects of our search on this end of the island. At the last cave before reaching the elephant seal beach there were 22 elephant seals hauled on a small sand bank and 14 just outside in the water. There appeared to be more of the animals on the rookery beach than on the day we made the count but we did not stop to check the earlier figures.

Cruising on down the west side of the island slowly we examined minutely every nook and corner where it appeared at all likely fur seals might be. At one p. m. we anchored off Jack's Bay, halfway down the island and went ashore to examine the ancient fur-seal rookery ground. Here was located originally a rookery with as many animals on it as any of the largest breeding grounds of the Pribilof Islands.

The boundaries of the great rookery could be traced almost exactly by the smooth and polished rocks which had been worn this way by the trampling of thousands upon thousands of flippers for many, many years. At the western end of the rookery there was the outline of the hauling ground for the adolescent males, the bachelors, extending far back of the beach line. And back of it there was a cañon with a causeway, fenced off with built-up rocks and logs of the native palm tree. The latter were thoroughly decayed showing that a great many years

had elapsed since they were put in place. At the upper end of the causeway on a little tableland was a corral, partially demolished.

The rookery proper occupied a fringe on a boulder beach about half a mile long lying east of the hauling ground. In front, and awash during the highest waves, there is a rough and jagged lava reef. The tide pools of this undoubtedly furnished admirable places for the young pups to learn to swim. At the eastern end of the rookery was what appeared to be the killing ground and a flat smooth area for pegging out the skins to dry. In the early days of fur-seal work this method of curing was employed instead of the use of salt which has been used now for about 75 years. At the eastern end of the rookery were the rock walls of eight houses. No framework was left. They were probably covered with the skins of the elephant seals.

We could not walk over this deserted ground without forming a picture of the grand sight it must have been when the first visitors built their rude huts and began the relentless slaughter of the fur-seal herd. Those who are familiar with the history of the Alaska fur-seal herd know what a waste there has been. It is recorded that the killing was done by Aleutian islanders brought down by the intrepid Yankee sailors for the purpose. The Aleutians were under the domination of Russia at that time and the Americans were able to arrange to do the work on shares; they were navigators, the Russians were not. It appears that parties of the Alaskan natives were landed with water at the rookery grounds and there left to make the season's catch. After the work was done the ship returned for them and took them away again. Evidently the greatest need was for water and a well had been dug near the buildings. It had caved in badly and showed no sign of moisture of any kind in the bottom.

It was here at Jack's Bay that Dr. Charles H. Townsend collected four fragmentary skulls of fur seals in 1888. They were found to represent a species decidedly distinct from the Alaska fur seal; in fact they were more closely related to those that live in the Antarctic regions than to those of the Arctic. The Guadalupe species was named *Arctocephalus townsendi* by

Dr. Merriam, and the four skulls in the original collection form the sole representation of the species in the world. Although many people have searched for the species since, it appears to be extinct.

In going over the rookery ground we had expectations of finding bones but were disappointed. It appears that in this desert air bones disintegrate very rapidly and fall to a powder. Even some bones of goats were almost completely destroyed and they could not have been there longer ago than about 1880. The great fur-seal rookeries were exploited chiefly between the years 1800 and 1810.

Here at Jack's Bay Messrs. Slevin and Tose collected various and sundry species of insects and shells and succeeded in getting one house mouse. This is a dry, barren part of the island and the mice have lived here for many generations, without water the greater part of the time, yet they do not appear to differ from this pest elsewhere.

I here succeeded in finding in the rock pools a few individuals of the marine shell *Uvanilla regina* Stearns, a beautiful species originally found on Guadalupe and not certainly known elsewhere.

That afternoon we sailed slowly down the remainder of the west side of the island but finding nothing of importance we anchored in the bight known as "South Anchorage" for the night.

Two fair-sized islets at the south end of Guadalupe known as Inner and Outer islands were examined minutely for fur seals but none was found. On a shelf of Inner Island we saw 14 California sea lions sleeping quietly in their solitude.

These islands are very interesting geologically. One is built of lava, like most of Guadalupe, and is a crater, bowl-shaped on the inside. The sea has eaten into the rocks so that a perpendicular wall is left all around. Next day from an elevation on Guadalupe we could see water inside the crater, but whether it was fresh or salt could not be determined. The other island rises out of the water, a sheer monolith with perpendicular walls going down into deep water. This one was composed of a light brown massive rock very decidedly different from the stratified lava of which the crater is built.

In the early morning of July 17 Messrs. Anthony, Tose, Hinkley, Barnhart and I went over the reef ground near South Anchorage, this being an excellent hauling place for fur seals should any be around, but not a sign of an animal was found.

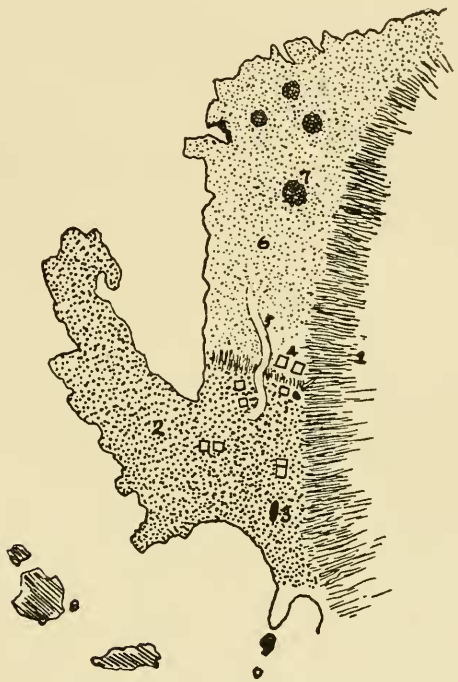


Fig. 2. Sketch of South Rookery, an abandoned fur seal breeding ground on Guadalupe Island.—1, Steep escarpment leading to high land above. —2, Main rookery ground, excessively rough with blocks and boulders of lava; many worn smooth and polished from trampling of the fur seals.—3, A wrecked dory.—4, Squares represent walls of human habitations.—5, Trail leading to smooth tableland about 50 feet above level of rookery.—6, Smooth sandy area used for pegging out seal skins to dry.—7, Round, flat topped piles of stones, presumably used for platforms for piling skins.

At one time this area was occupied by a vast rookery of Guadalupe fur seals. As at Jack's Bay the boundaries were plainly traceable by the flipper-polished rocks. The rookery occupied a stretch of coastline at least three-fourths of a mile long, the rocks being greatly worn; evidently the ground was occupied for a very long period of time and if this feature be a safe means of estimating the age of a rookery, then Guada-

lupe was inhabited much before the Pribilof Islands by the herds there.

On top of a tableland was a smoothed-off area used as a pegging-out ground, in many cases the pegs were still present but grealy worn by the wind blown sand. Piles of boulders, carefully arranged in circles may have been used as a place to put the fresh skins before pegging to keep them clean and free of sand; no other use could be thought of to which they might have been put. (See pl. 15, fig. 2.)

Near the beach line there were the remains of the stone walls of nine houses, similar in every way to those previously seen at Jack's Bay. (See pl. 17, fig. 1.)

The country at this end of the island is an exceedingly barren desert, where even the goats find difficulty in maintaining an existence. The uplands were very rough and rugged with strewn lava and in one patch of this a little cactus belonging to the genus Mammillaria was collected. Until then the only other form of this group found was the "cholla."

Under some vegetation near the beach Mr. Slevin and I collected two species of Hemiptera and two beetles we had not previously found on the island.

In the afternoon we continued slowly with the ship up the eastern side of the island, examining the shores very carefully for fur seals. About two miles north of the south end of the island we found more ancient rookery ground, the occupied area being only about one-half mile long, but near by were the remains of 19 houses. Evidently this was the most favorably located of the rookeries for human habitation although we could see little reason for choice in the matter. Probably the workmen here walked across to the other rookeries for sealing work.

Of course we were much disappointed at finding no living fur seals. It would seem that if the last hunters had left any breeding animals at all, they would have increased sufficiently by now to have been seen under the close scrutiny we gave the shores. The absence of bones on the old killing fields and rookeries also disappointed us because we had hoped to be able to add at least some portions of skeletons to the collections.

After we had cruised northward along the eastern shore to the point where we left off with the rowboat a few days before,

the ship was headed for San Quintin Bay on the peninsula of Lower California.

This we reached at two p. m. of July 18 and Messrs. Anthony, Tose, Slevin, Barnhart and I went ashore to collect on the west side of the bay.

Miscellaneous specimens of various kinds were taken, among which were a rattlesnake and a lizard, found by Mr. Slevin. These pleased him very much because up to this time he had not gotten anything for the Department of Herpetology. He had been unable to verify the vague reports of the lizard on Guadalupe.[14]

The remainder of our party went ashore on the east side of the bay at the village to arrange for the use of an automobile the following day.

The next morning, July 19, Messrs. Angulo, Cuesta-Terron, Anthony, Slevin and I secured a light automobile in the village of San Quintin for use during the day. Mr. Green, the postmaster, owned the machine and we drove northeastward about 15 miles, diagonally across a level plain, then over gently rolling hills to the mouth of a cañon which comes out of higher mountainous country to the eastward. At the mouth of the cañon there is a huge land-mark in the form of a red rock escarpment and near by a well kept farm has the name "Red Rock Ranch." We were treated to huge figs, four inches long, delicious watermelons and tomatoes, all irrigated with water from the stream in the cañon.

From the ranch we drove up this stream about three miles to the Mission of Santo Domingo, once a populous and important station on the line of civilized habitations from the capital of Lower and Upper California, Loreto, to San Francisco. Now a few natives were left and they seemed to be fairly prosperous, with well kept farms and houses. Conspicuous among the buildings was a schoolhouse which would be a credit to many small communities in the United States. The "dobe" walls of the mission yard were mostly in ruins but one of the buildings was still well kept and was used regularly for church services.

[14] See Green, Bulletin Calif. Acad. Sci., Vol. 1, 1885, p. 220, who reported having seen "two or three small lizards." Mr. Slevin thinks that if a species of lizard did once live on the island it is probable that the cats have destroyed them all by now.

Collecting in this vicinity was not particularly encouraging so we returned early to the plains where a few antelope ground squirrels were taken as they rested, bird fashion, in the tops of the sage brush. Also just before dusk Captain Angulo and others derived considerable pleasure in securing some jack rabbits for us for specimens. I had missed an easy rifle shot at a coyote early in the afternoon and it took me some time to recover.

The village of San Quintin consisted of a few miscellaneous houses, the most conspicuous of which was the old "Company House." Many years before, this had been the scene of considerable activity by a "colonization" company but it did not turn out well. Mr. Anthony had been with the company as a surveyor and had collected many valuable specimens of birds in this vicinity. The place was also interesting to those of us from the California Academy of Sciences because our Secretary, Mr. W. W. Sargeant, had also been on hand with the first contingent of "settlers."

While we were working on the east side of the bay, Messrs. Gallegos, Tose, Hinkley and Barnhart collected on the west side and secured many valuable specimens.

On July 20, Messrs. Anthony, Gallegos, Slevin, Barnhart and Tose worked on the west side of the bay adding many more specimens to our rapidly growing collection.

I found it profitable to visit some low cliffs, not over 20 feet high, on the east side of the bay and just south of the village. Here I succeeded in getting a very large collection of fossil shells consisting of several thousand specimens.

The geology in the vicinity of San Quintin is comparatively simple. In late Pleistocene the present bay was a broad indentation of the sea and ocean-living species were very abundant. Subsequent elevation raised the bottom on the east side in a broad fold. The preservation of the fossil shells is excellent, many of them retaining some of the original coloration. How far back toward the foothills this embayment extended cannot be determined but probably it went to the first terrace, the beginning of a long series of rolling hills or mesa. This terrace is said also to contain fossils but none were secured. It is probably much older than the outcrops on the bay. The moun-

tainous country to the east of this terrace is metamorphic, the age not having been determined.

On the west side of the bay there is a chain of low volcanic cones not over 300 feet high. Lava has spread outward from these as far as the bay shore and on top of a broad shelf of this there are other Pleistocene marine sediments but with a different set of fossils. Among those collected were some huge Schizotherous clams, fully eight inches long.

The broad plain east of the bay was once occupied by great numbers of deer and antelope but they have almost disappeared on account of the activities of "sportsmen" from further north, and hunters employed by mining companies to provide fresh meat for their camps.

On July 21 we completed our work at San Quintin Bay. Messrs. Anthony, Slevin, Tose, Gallegos, Hinkley and I all worked at collecting on the west side. A few insects were found but no species was abundant. Coyotes, wood rats, and rabbits were abundant, as well as several species of desert field mice. One of the rarities collected was a very small species of shrew. Birds were very scarce about the bush-covered hills, Bell's sparrow being the dominant form. Mr. Slevin succeeding in securing eight rattlesnakes for the collection, a few of them being taken by other members of the party. There is no question but experience in this as in other lines makes for efficiency. He seemed to know just which brush thickets to explore and with his little .22 caliber shot pistol he captured three other species of snakes as well as a large number of lizards belonging to five or more species.

Three species of land snails were very common among the brush thickets on the west side, the most noticeable one being the large *Micrarionta stearnsiana* here about to the southern extremity of its range.

We left the bay at four p. m. and slowly made our way out through the tortuous channel at the entrance. This is so difficult to follow that it would be dangerous for a boat much larger than the *Tecate* or for a navigator unfamiliar with the water.

During the night Mr. Barnhart took water and plankton samples at regular intervals on the way to Cedros Island. I

relieved him at five a. m. At one place a peculiar temperature condition was found; this dropped about five degrees in a distance of eight miles and rose suddenly on the opposite side. This was interpreted to mean a submarine obstruction to the free flow of currents and a consequent "up-welling" of the colder waters from below.

At eight a. m. of July 22 we were in sight of Cedros Island and the east shore was followed southward. The sea was without a ripple and as we cruised close in shore we were able to note some of the interesting features of this remarkable island. Near the north end we passed the site of a copper and gold mine, abandoned long ago. It was visited later and notes were made of surroundings.

Nearly every slightly elevated rocky pinnacle or promontory along the shore was occupied by a pair of ospreys with their nest. In some of these young birds could be seen, almost as large as their parents.

About halfway between the north end and the Grand Cañon in the center of the island, a crosswise fault extends northwest. On the south side of this break what appeared to be Tertiary sediments had been elevated about 200 feet above the sea. This deposit extends southward about two miles and is lost beneath the sea due to another fault. This elevation is entirely distinct from another which has lifted the greater part of the east side of the island out of the water about 20 feet. The old beach line was plainly seen from the ship.

At noon we landed near the south end of the island where Bernstein Brothers of San Quintin and San Diego have an abalone packing plant. They have two outlying collecting camps with two divers each and enough of these fine mollusks are obtained to keep 14 shore men employed.

The plant consisted of boiler, cooking vats, and wire drying frames. Canning machinery and a dock were in course of installation. They had a large launch which made regular runs to San Diego and two smaller ones to attend the collecting camps.

The abalones were brought in in the shell and consisted chiefly of the species, *Haliotus corrugata*. The meats were cooked three times in boiling water at intervals of a week or

two. Between times they were dried in the sun on the wire netting, the entire process taking about six weeks.

The meat when dry is hard as a piece of untanned leather and is brown in color but it has a very agreeable flavor. The product is shipped to China and Hawaii, some of the shells going elsewhere to various markets. It was stated by the Superintendent, Mr. Charles Bernstein, that five tons of fresh meat made one ton dried.

In the afternoon all of the party went ashore for collecting. Most of us followed the pipe line inland about two miles and thence another mile to a large spring. Here a permanent supply of very good water is had. At the source a very considerable area is grown up with rank water vegetation and no doubt the accumulation of this through years has retarded the flow of water somewhat. If it were cleaned out probably a sufficient supply could be had for much greater industrial needs or even a limited amount of irrigation.

Tracks of deer and goats were abundant about the spring and a few small trees cast a most welcome shade. Birds were excessively scarce and so wild as to be almost unobtainable. Some rather interesting insects were found, among others being a huge dragonfly four inches long. Numerous land shells peculiar to Cedros Island were picked from certain desert plants. They were hibernating in closely-sealed shells. In the spring, large numbers of a minute freshwater gastropod were found, probably belonging to the genus Paludestrina. Also there and in the stream leading to the pipe line entrance, Mr. Slevin collected numerous specimens of a small frog.

Here we made our first acquaintance with that strange monstrosity, the elephant tree of Cedros. It grows very close to the ground, the highest being not more than about 12 feet tall. At the base many of them were fully two feet in diameter and the thick club-shaped limbs taper rapidly to nothing. The trees had shed their leaves but were in full bloom, each one a gorgeous mass of beautiful pink.

We made a much more extended stay on Cedros on our return and detailed observations will be left until we come to that. But that evening Mr. Anthony and I put out many traps hoping to catch a very small pocket gopher which I saw during

the afternoon. Our attempt was futile, but we did capture a lizard in our trap which Mr. Slevin stated had not previously been taken on Cedros. Strange to say, he did not get another specimen.

At seven a. m. of July 23 we sailed for Magdalena Bay, far to the southward. Between Natividad Island and the peninsula great numbers of cormorants were flying from east to west in long flocks. For half an hour they passed at a rate conservatively estimated at 100 per minute.

Many petrels and shearwaters were seen but no albatrosses cared to follow us south of Cedros Island. During the day we sailed for hours through loose flocks of red phalaropes. They were evidently southward bound but found time to engage busily in catching minute animal life from the surface of the sea for food.

On July 24 we had four hours' delay out at sea due to engine trouble, but our engineer seemed to be able to apply the proper remedy and we continued later to Magdalena Bay, arriving after nightfall. During our stop at sea a collection of surface dwelling organisms was secured with a dip net. Among the interesting forms thus secured were several larval fishes; among them we were able to identify pipe fishes, flying fishes, and the bonito or skipjack of the mackerel family. Some of these were barely out of the egg and they offer a possible clue to the breeding area of the tuna for which the naturalists of the U. S. S. *Albatross* searched in vain for several years.

We passed Cape San Lazaro as the sun settled behind a bank of clouds on the western horizon leaving the brilliantly shining stars to light a tranquil sea. The atmosphere, the water, everything about us told us in unmistakable terms that we were approaching the tropics.

As we entered the bay we passed close to Sail Rock, a target for the U. S. Navy in other days, and at nine-thirty p. m. we anchored in front of the village of Magdalena.

During the trip down from Cedros Island whales were sighted only twice. The scarcity of these cetaceans was a surprise because it was in these waters that much of the pelagic whale industry was concentrated during the early part of the 19th century.

Swordfish and tuna were common on the way down and we caught a few bonito and skipjack on the gig. Some of the bonito contained ripe eggs indicating that the spawning season was at hand.

Man-o-war birds, Heermann's gulls, elegant terns and brown pelicans came to meet us when we were about 15 miles out from the bay. In the late evening red phalaropes settled abundantly on the water; some of them still retained the red plumage of the breeding season. A black-footed albatross sailed past us in the afternoon and after one look departed in disgust. Least, Soccoro, black and Kaeding's petrels were common all day, their lazy but tireless flight often being the only sign of life on a glassy sea.

In the morning of July 25 Messrs. Tose and Hinkley went south from the village along the bay shore and by noon had collected about 20 birds.

Mr. Anthony and I went north to a mangrove swamp where four hours were spent in the almost impenetrable tangle, often up to the waist in mud and water. In this we succeeded in securing three specimens of the rare mangrove warbler but did not get one of the rails which we could hear from time to time. It is said that these birds blend into their surroundings so perfectly that it is only by long experience that the collector is able to secure them with regularity.

Mr. Slevin worked north of the village and took about 70 lizards and two snakes.

Magdalena Bay is so large that the eastern shore cannot be seen from the village on the west side. North and south there is inland water for about 100 miles, much of it shoal but the anchoring ground is large and safe. There are a great many sand and mud flats and lagoons lined with mangroves and coarse grasses. In these lagoons there were formerly great numbers of turtles and their bones and shells still line the beaches. California gray whales used to visit the lagoons but the species now appears virtually extinct. Porpoises, however, were often seen in the bay waters.

The village of Magdalena consists of several frame houses and concrete warehouses. It was established as a concession granted to a colonization company, not now in existence. The

chief source of revenue was the lichen called "Orchilla." This grows luxuriantly on cactus and other desert plants of the region and was shipped to Germany for use in dye manufacture until chemists working with coal tar derivatives obtained better colors. Boats seldom call at the village any more. A company of marines located here had just completed the erection of a radio station.

Water has to be brought by boat from the east side of the bay, there being none near where the village is located. The important commodity sells for 50 cents per barrel.

On July 26 Mr. Anthony and I again visited the mangrove swamp and succeeded in securing seven more mangrove warblers. Also three Xantus' jays were taken; this is likewise a rare species in ornithological collections. I was surprised to find numerous living specimens of a huge Littorina adhering to the semisubmerged roots of the mangrove.

We walked across the sand dunes to the ocean beach to the westward where a considerable number of marine mollusks was collected. This seemed to be a favorite place for the capture of turtles by the people of Magdalena. We counted 65 shells of those recently killed. The sex of at least 40 could be determined and they were all found to be females. It is said the turtles are killed with harpoons as they approach the sand beaches to lay their eggs.

Mr. Slevin continued to add largely to the collection of reptiles, the most important being three specimens of a lizard called "whip-tail." He took four on the previous day; only one had been known previously.

Other members of the party were variously engaged; Sr. Gallegos continued to add to his collection of insects and plants; and Messrs. Tose and Hinkley worked with the birds continuously.

On the morning of July 27 Mr. Anthony brought in all of the traps which had been placed out at this place. Very few specimens of mammals were taken and they were chiefly rats of the genus Neotoma and desert mice belonging to Peromyscus and Perognathus.

I spent the morning collecting fossil shells from a large deposit which is exposed to an elevation of 20 feet above the bay

immediately north of the village a few rods. Here in a soft unconsolidated sand were great numbers of shells, many species being rare in collections. The age of the deposit is Pleistocene and it represents an elevated beach line similar to what has already been described at San Quintin and Cedros Island. Prior to this late elevation the land on which the village stands was an island and Magdalena Bay had a broad entrance to the northward. This permitted free entrance of ocean water and with it ocean-dwelling species of animals. With the elevation of the land the north entrance was closed but the lagoon extending far to the northward inside the belt of seashore sand dunes is a remnant of it. It is said that this lagoon is connected with the sea to the northward thus in fact leaving Magdalena an island at present although it is more like a peninsula. The mountains back of the village are metamorphic and igneous and therefore have been above the sea for a long period of time. During the Pleistocene at least, the range was an island, far removed from other high land, and even now partakes of the characters of an island. Therefore, it would be expected that sedentary animals such as mammals and insects, and also the plants, would have been modified by isolation and have become separate species or subspecies. This appears to be true in many cases.

We left the anchorage at Magdalena at noon of July 27 and went to the village located on Santa Margarita Island 20 miles to the southward. To get there we had to pass through a rather difficult channel, the southern half of the bay being much shallower than the northern.

Santa Margarita Island occupies the same position with reference to Magdalena Bay as the San Francisco Peninsula does to San Francisco Bay. The island has been subjected to the same elevation of Pleistocene sediments around the shore lines as has been described for other places. It is divided into two parts both the northern and southern being mountainous and composed of metamorphic or igneous rocks. The low pass two miles long, north and south, connecting the two parts, is level and on the western side is fringed by a belt of enormous sand dunes. Near the center of the isthmus country there is a zone of sedimentary rocks chiefly thinly bedded but hard sand-

stones. No fossils could be found in them but they had the appearance of being pre-tertiary on account of the alteration which has taken place. The strata dip to the westward about 80° and strike about northeast-southwest.

A great deal of magnesite has been collected about the lower slopes of the mountains of both sections of the island. Comparatively large quantities have been shipped out and some trucks and other machinery were still on hand. It was understood that under the laws of Mexico the concession under which the deposit had been exploited had been automatically cancelled not long before our arrival. The manner of formation of the magnesite is an interesting problem, a solution of which was not evident from my brief study. The mineral seemed to be fairly pure and occurred chiefly as loose chunks or nodules having mammillary structure, as though deposited from mineral springs.

Here at Santa Margarita was a well equipped plant for the manufacture of oil and meal from fish. It was idle at the time but in good condition. Apparently some difficulties had arisen in regard to the collection of the fish for working up. It was said that a small species resembling an anchovy was the chief raw material and no difficulty had been encountered in securing a sufficient supply by the use of a 200-foot seine on the neighboring beaches. By this method many other species were secured; particularly abundant were several species of sharks.

Near the wharf there was a building which had been put up for use as a turtle cannery. It had a concrete floor and was used as a habitation at the time of our visit. Much of the machinery was still in place. We were informed that the original concession had been granted many years previously to a man named O. Sandaval but no attempt at operation had been made for 15 or more years.

The ship was tied up to the dock here and most of us went ashore. Mr. Anthony and I put out some traps and collected a few desirable birds. We also found a snake (a black racer) which Mr. Slevin considered very desirable. I found many excellent specimens of a species of land shell (Bulimulus) related to a form which lives in the Cape Region farther south

on the peninsula. Mr. Hinkley secured a specimen of the endemic and greatly desired jack rabbit. Mr. Slevin secured all previously recorded species of reptiles except a rattlesnake.

This seemed like a very excellent collecting station and we regretted that we could not spend a week or a month in the vicinity. Across the bay to the eastward the great and intricate mangrove swamps and islands invite the naturalist most enticingly. Mr. Barnhart found a strange water temperature condition in Magdalena Bay. Where we anchored at Magdalena it was 64°F. Farther out and closer to the entrance it was 68°. Outside it was 74° and at Margarita it was 71°. Why is the water so cold in the north part of the bay? We could not suggest an answer.

On the morning of July 28 we found only four mammals in the traps, two wood rats and two mice (Perognathus). I shot two bats near the wharf in the early morning light as they were flying along a low cliff near the fertilizer plant.

Mr. Slevin and I walked south into the mountains of the south half of the island, thence to the "ranch" on the west side of the isthmus, and back through the mountains of the north half. Numerous interesting birds were taken some of which belong to the fauna of the Cape Region. This appears to be the extreme northern limit of distribution of this remarkable fauna. Woodpeckers and cardinals, peculiar to the region south were especially attractive. The former make their nesting holes in the trunks of the giant cactus. The cardinal's song did not appear to differ from that of the familiar bird of the middle west although this one is a different species.

Among the reptiles collected there were several specimens of a desert iguana which is an excessively rapid runner. In action the tail is folded upward, the front legs placed close beside the body and the hind legs only are used.

Messrs. Anthony, Tose and Hinkley secured some more desirable birds and another jack rabbit. Insects were very scarce but we secured a few species.

The climate at Magdalena is very uniform throughout the year. The nights are cool, the days hot. A breeze usually blows on the water in the afternoon but inland that part of the day is uncomfortably warm. Rain seldom falls, sometimes

only at intervals of years. Far to the eastward over the Gulf of California, black clouds with flashes of lightning were plainly visible at night.

At the so-called "ranch" one family lived in a shed with brush roof, no walls, doors or stove. They had a small patch cleared of brush where watermelons, tomatoes, and date palms were growing with practically no attention. Water was available at about 15 feet depth and was used for household purposes but we found it to be too salty to satisfy our thirsts. The ranch is in a valley of about 10 square miles densely grown with brush, small trees and giant cactus. Undoubtedly there is fairly fresh water at a moderate depth over the entire area. It would seem that farming could be more extensively prosecuted if there was a market for the product.

July 29 proved to be an excellent day for collecting. Messrs. Cuesta-Terron, Slevin, Gallegos, Tose, Barnhart, Hinkley, Anthony, Captain Angulo and I went across the isthmus to the ranch, the Captain being the pilot of one of the auto trucks left behind by the magnesite company. He proved his ability as a navigator on land as well as on the sea.

Considerable time was spent in the giant cactus forest where we found ripe fruit as large as a medium sized orange and with a flavor similar to a raspberry. They were delicious eating and were very effective in allaying the thirst the uninitiated always experiences in a hot desert afternoon.

Many birds were found in this forest, the most important for us being the Cape Region species. The woodpeckers were evidently very fond of the cactus fruit and many ospreys had selected these strange trees for nesting sites. Some of the bulky structures had become so heavy through years of additions that the trees had collapsed.[15]

The rank desert vegetation of the vicinity of the "ranch" enabled us to secure some attractive insects, and two species of land shells (Bulimulus and Micrarionta) were common. Mr. Slevin made very important additions to the reptile collection, one being a rattlesnake not previously known from this island.

Another specimen of the jack rabbit was taken, this making

[15] See figures in Nat. Geog. Mag., Vol. 44, No. 1, July, 1923, pp. 90, 91.

the third for our party, and the Mexican naturalists have taken one.

On the morning of July 30 we ran the line of traps at the first break of day in hopes of getting to our specimens before the ants, but we were unsuccessful. The voracious insects had completely spoiled several otherwise valuable specimens; all we could do was to preserve them in alcohol. The ants are nocturnal in most of the places in which we have trapped this season and an animal is no sooner caught than it is attacked. In spite of this difficulty Santa Margarita Island furnished us with several specimens of very rare desert mice.

It was with reluctance that we left this anchorage at nine a. m. and started northward on the journey back to San Diego.

At one p. m. of July 31 we anchored behind the point of land known as Abreojos (eyes open). On the way north we followed the shore sufficiently close so that we would have discovered any herd of elephant seals or other conspicuous animals which might have been hauled out. It was in one of the long bights of this shore line that Dr. C. H. Townsend collected several elephant seals for the National Museum about 1888.

Messrs. Anthony, Gallegos, Slevin, Barnhart and I went ashore for collecting, the landing being made at two shacks used in other seasons by spiny lobster fishermen. Many turtle bones, lobster carcasses and mollusks were drifted upon the beach. I could not help but regret that equipment was not available to dredge the ocean bottom because it was here that Henry Hemphill had made a very extensive collection of shells many years ago. Numerous species taken there by him have not been found elsewhere.

The most conspicuous shells on the beach were the pismo clam. It is prophesied that here will be an important fishery for this mollusk at some future date.

A burro trail with fresh tracks led to the northeast to another lobster camp toward San Ignacio lagoon.

Mr. Anthony stated that the plain back of this point is one of the few remaining ranges of the pronghorn antelope. A fairly fresh horn was picked up near the camp, so the species is probably not yet exterminated.

No land snails could be found in the limited time devoted to the search.

An examination was made of the geological structure outcropping on the shore at the first point northeast of the usual anchorage. Here for about 1000 feet there was an exposure of hard sandstone and shale, dipping southwest at an angle of about 15°. Above, and unconformably upon that series is an even greater thickness of heavy conglomerate which weathers slowly and forms rocky projecting reefs upon which grow the great kelp gardens of the point. Above the conglomerate late Pleistocene sediments rest with great angular unconformity. The shells, however, were not well preserved. Fishes were exceedingly abundant about the point.

We arrived at Asuncion Island on August 1 at eleven a. m. and the anchor had scarcely been dropped when some one of the crew caught a "jewfish" weighing about 150 pounds. Later one was taken which weighed nearly 400 pounds. Several bonito were taken on the troll before we arrived.

Most of the party went ashore soon after arrival. Messrs. Anthony, Cuesta-Terron and I examined all shores carefully for fur seals but found none. At the same time I estimated each group of California sea lions as we passed. The figures of course were hurriedly arrived at but the total, males, females and young, was close to 4000 animals.[16] To this, as an integral part of this rookery, should be added about 1000, subsequently found on Angulo Rock near by. All of the beaches were lined with the animals and they kept up an incessant roar with their barking. Harems seemed to contain from 15 to 18 cows and the young pups were learning to swim in the tide pools. Many of the bulls were badly scarred from fighting, a condition which would largely disappear if some of the surplus males could be eliminated.

This species was found to be very abundant on most of the favorable breeding grounds south of the Mexican Boundary. There are likewise large rookeries off the coast of California. Certainly the species has sufficiently recovered from its early persecution for the surplus males to be taken for commercial purposes. The skins are large, uniform in thickness, and make

[16] See figures in Nat. Geog. Mag., Vol. 44, No. 1, July, 1923, pp. 85, 86.

excellent leather. The fat and flesh make an oil and animal meal of a quality which is equal to, or better than, the average derived from whales.

The manner in which the commercialization of such a species can be undertaken without exposing it to unlimited slaughter is a problem difficult indeed to solve. Permits or concessions might be granted to private parties by Mexico and California, limiting the catch to males only and the number to be specified by proper authorities after investigation. While this method of operation looks practicable at first glance it apparently never works out to any other conclusion than the commercial extermination of the species concerned. It has been tried repeatedly in many different countries and has always failed to perpetuate the species in the same abundance with which the work was started.

Another plan of operation, often suggested and tried is to permit unrestricted slaughter by all persons during an open season. This likewise almost always fails in the perpetuation of a marine species in its original abundance and there are few successes with land animals. The reason is not hard to find. When such slaughter begins large catches are made with ease but as more people engage in the enterprise and the number of individuals of the species hunted becomes smaller, increased efforts must be expended to get a profitable catch. These efforts are of two classes; (1) political activity such as the securing of longer open seasons, and fewer restrictions, bribing of enforcement officials, etc.; and (2) increased efficiency of hunters.

One of the most difficult of all classes of beneficial legislation to secure is a measure to more adequately conserve or perpetuate a wild species which is being commercially exploited. Practically never are commercial interests willing to submit to protective restrictions until the species with which they are concerned is approaching industrial extinction.

Therefore, the time to provide and apply protective measures is when the species is still abundant and not exploited.

In the case of the California sea lions I think absolute prohibition of any slaughter whatsoever should be maintained by Mexico in its territorial limits as well as on the high seas.

The same should be done by California and the United States. While this is in force a treaty should be made between the two countries whereby no killing would ever be permitted except on land and by duly authorized agents of the respective governments.

In this manner the Fish and Game Commissions of the two countries could develop a market for the amount of surplus available and for that only. Revenues of course would pass to the governments.

Objection to this method of operation is possible because it may suggest certain doctrines of socialism, but it has been tried and found successful, whereas no other method ever has succeeded in conserving a species of marine mammal.

On Asuncion Island Mr. Slevin took 30 specimens of one species of lizard; no others appear to live there. Land shells were scarce and semifossilized; no live ones were found. Insects also were very rare but we succeeded in finding six species.

The island is a vast roosting place for birds, but few species breed. Brandt's cormorant is the most abundant of the latter and these form black, close, compact "islands" on the level stretches of white sand. Each mass contains a thousand or more birds. This close association seems to be for the purpose of protection from the gulls because, ordinarily, these did not molest the shags at all. But if we disturbed the "island" colony at all, causing the parents to desert young or eggs, the gulls flocked down in great numbers, breaking eggs and killing young indiscriminately. After we learned this we endeavored to cause as little disturbance in the island routine as possible.

The Brandt's cormorant builds its nest of marine algæ and the structures are low and filthy. The Farallon cormorant, which is common on the higher land, builds its nest of sticks and lines it with quill feathers. Some of the nests were built in the low trampled bushes of the island; others were placed in the open and raised to a height of three feet.[17]

A few pairs of brown pelicans nest on the island, but it is chiefly a roosting place for hundreds of thousands of these birds.

[17] See figures in Nat. Geog. Mag., Vol. 44, No. 1, July, 1923, pp. 92, 93.

The western gull nests in small numbers and there were burrows of Cassin's auklet or some shearwater everywhere where there was soil. These holes were unoccupied.

Both species of cormorants and the pelicans had fairly fresh eggs, newly hatched young and young ready to fly, so the nesting season must be greatly prolonged.

Frazer's oystercatchers and black turnstones were fairly common and in the late evening a few Heermann's gulls flew in.

The vicinity of Asuncion Island is wonderfully rich in marine life. A huge jelly fish, vivid magenta in color, and with streamers 20 feet long was abundant. South of the island 20 miles there was a sudden lowering of the temperature of the sea water to 61° F., 13° colder than outside Magdalena Bay. The cold water probably accounts for the abundance of sea life, at least in part.

A short distance northwest of Asuncion Island there is a flat-topped rock 50 feet high on which we collected eight species of beetles in less than an hour. The rock is very conspicuous as the island is approached from the south. Because of the different species of insects from those found on Asuncion, a name for this rock is needed and we proposed to honor it with the name of our congenial captain, Victor Angulo.

Geologically, Asuncion Island is composed almost entirely of Jurassic Franciscan Chert, or a chert which is very similar to this widespread and well known formation in California. On the north side there appeared to be some metamorphism. The island, like so many other places in the region, has been subjected to a comparatively recent short submergence and subsequent elevation to about 25 feet.

Traps were put out in the evening and next morning they contained 14 specimens of Peromyscus.

On August 2 we left Asuncion Island at six a. m. and went ashore on San Roque Island at seven-thirty a. m. It is similar in almost every way to Asuncion but is only about 65 feet high. The steamer *San Jose* went on the rocks here in 1921 and there was a great deal of wreckage strewn about. The hull was firmly wedged between the rocks.

Brandt's cormorants were found in enormous numbers but the only nests of the Farallon species were around the shores on piles of driftwood. About 1,000 Heermann's gulls were perched on one rock; very few young were among them.

Several hair seals were seen in the water in the bight on the south side of the island but all efforts to secure specimens failed. Field mice were abundant but we took none during our short stay. No land shells were found and only three species of beetles were taken.

We left San Roque at eleven a. m. and anchored in the north end of San Bartolome (Turtle) Bay at six p. m. Messrs. Anthony, Tose, Slevin and I went ashore with a lantern after dark. Traps were put out and in a bunch of sagebrush we found a rattlesnake which Mr. Slevin promptly shot.

The low sea cliff at the landing consisted of sandstones dipping to the westward. Several species of fossils were collected which later showed the age of the rocks to be Pliocene.

Two Peromyscus were found in the traps next morning (August 3) and we left San Bartolome Bay at six-thirty a. m. It was an exceedingly attractive place to work but our mission was insular and we could not stay.

At nine a. m. we went ashore on the south end of Natividad Island, where the entire party worked all day.

This is another bird island *par excellence*. Gulls, shearwaters and cormorants nest on the highest parts. Many pelicans were seen resting but none seemed to nest. The Brandt's cormorants form "islands" on the level stretches near shore, while the Farallon species goes to the higher interior and builds nests as on Asuncion Island.

Of land birds we saw only desert sparrows, ravens and duck hawks. The latter nest on the island in very accessible places; a person could walk directly to some of the nests.

The island is tunneled with the burrows of black-vented shearwaters. About 40 of these burrows were excavated and five birds were thus secured. One was a young of the year, the others adult. Apparently the birds continued to visit their burrows long after the nesting work was done. About eight species of insects were secured. Dead land shells (Micrarionta)

were everywhere in abundance but not a live one could be found. Mr. Slevin took two species of lizards.

Geologically the island is very old. Shales and sandstones inclined from 0° to 75°, extend from the south end northward at least four miles. No fossils were found and the age was not definitely determinable but the sediments are certainly older than Tertiary. The island has been subjected to a recent submergence down to at least 100 feet. It was then elevated before any considerable quantity of sediment could accumulate.

Six species of cactus were seen, the most conspicuous being the long shafts of the group commonly called giant cactus. Shrubbery was very scarce but there was abundant evidence to show that when there is rain a quick and luxuriant growth of succulent plants follows quickly. All were dead and parched when we were there.

On August 4 the traps on Natividad Island were found to contain 11 Peromyscus. Many of the traps had been sprung by ravens and gulls. Those most successful were set about some bushes which contained very filthy cormorants' nests; there were numerous mouse-burrows under the nests. Some specimens were also taken in the traps set in shearwater burrows, these seemingly forming a haven for mice and lizards as well as birds.

We left Natividad Island soon after daylight and arrived again at Bernstein's abalone plant on Cedros Island at nine a. m. Everyone was glad to get ashore here for various reasons, chiefly because of the abundance of freshwater. The party divided in various directions.

Mr. Slevin and I visited the spring from which the water supply is derived and secured more detailed observations on this little oasis. It is situated on the crest of a ridge between 2,000 and 3,000 feet high and an area of two or three acres is overgrown with rank vegetation. Cedar trees and elephant trees grow around the margin and some of the grass is 10 feet high. Many strange plants and insects were collected. Birds were not common and were excessively wild. Where the water first flows out it is delicious but as it flows down the cañon to the reservoir intake of the pipe line it passes through a mineralized belt and takes up a considerable amount of this.

If the pipe were extended to the spring itself a much larger and better supply of water would be obtained. (See pl. 18, fig. 2.)

Our complete line of traps put out late in the evening did not contain a single mammal on the morning of August 5. Signs of Perognathus were abundant but the animals consistently avoided any bait we offered. We went after them with pick and shovel on the 5th and succeeded in capturing one.

In the afternoon I put some traps out in a cañon about two miles above the camp where the only sign of woodrats had been found on this end of the island. In setting the line I found a rattlesnake in a hole under a bank and Mr. Slevin came to my aid with his trusty pistol. It turned out to be *Crotalus exsul* the type locality of which is Cedros Island.

A good series of fossils from the Pliocene beds south of the camp was obtained during the day.

On August 6 we found our traps had caught one woodrat and three Peromyscus. One more of the latter was taken during the day. Messrs. Tose and Hinkley visited the spring and secured several birds. They also took one cottontail rabbit, a few of which had previously been taken there by some of us.

Mr. Slevin and I went almost to the top of Mt. Cedros northwest of the camp. Stunted cedars are scattered over the upper 1,000 feet of the mountain and cactus was common there. No deer were seen but we came across a small herd of goats. For some reason these animals have not increased as they did on Guadalupe. The elephant trees grow to the very top of the island and some of them, long cut away, indicated a trail. The bark of the tree is white or buff and peels off like a paper birch. The outer layer is very thin; this is followed by a green layer, also very thin; and that in turn by a pulpy part about one inch thick. When the bark is punctured a thick, sticky, cream-like liquid exudes in considerable quantities at the season of our visit. (See pl. 19, fig. 1.)

In the early morning of August 7 the ship was moved to the mouth of Grand Cañon, about the middle of the eastern shore and collections were made throughout the day.

Three male deer were shot and carried to the beach. The animals are here very common, tame and unafraid. One was

taken with the .22 caliber rifle. Trails were well beaten from the shore to the highest point.

In this valley there are some fine groves of elephant trees, the largest seen thus far. The cedars are found from a little above sea level to the top of the mountains but they are small and stunted. No trees comparable to those 12 inches in diameter at Bernstein's spring, were found.

Messrs. Slevin, Anthony, the Chief Engineer of the *Tecate* and I went to the top of the Pine Ridge on the north side of the cañon. This was photographed by Dr. Townsend[18] from the bottom of the cañon and the pine trees standing soldier-like on the rim were mistaken for "cedars." (See pl. 18, fig. 1.) He mentioned "one spring" in the cañon but every branch cañon we explored had one or more. In some there was water in considerable amount but no place was the vegetation as rank as about the one from which Messrs. Bernstein get their water. Above one spring there were the stone walls of an old cabin, long ago abandoned. Some assayer's supplies near by indicated that it may have been a camp of a prospecting party.

On the morning of August 8 our traps contained only one woodrat, two Peromyscus and one Perognathus. Captain Angulo, the Chief Engineer and I went up the cañon again in search of deer and succeeded in getting a female for the collection. This species of deer is found only on Cedros Island and was reported extinct at one time. There were no specimens of it in any western museum prior to our visit, so, in view of the abundance of the species, we felt justified in taking four. The doe taken today was prepared for the National Museum of Mexico.

In view of the fact that the Cedros Island deer has been reduced in numbers, at least once, to the verge of extinction through the activities of hunters and the likelihood of the same being repeated whenever people in large numbers visit that region, the Mexican naturalists on the expedition, Messrs. Cuesta-Terron and Gallegos, determined to make recommendations to their government for some means of protection of the species. Accordingly, upon their return, the situation was explained to the Secretary of Agriculture and Public Works and

[18] Bull. Am. Mus. Nat. Hist., Vol. 35, 1916, p. 411, fig. 9.

on May 28, 1923, the killing of this deer was prohibited from June 1, 1923, to May 31, 1928, through the issuance of a proclamation by the President of Mexico.

Since this action was taken as a direct result of investigations made by this expedition, the text of the proclamation is herewith quoted in full, the translation into English from the Spanish having been made by Miss M. E. McLellan of the California Academy of Sciences.

## SUBJECT

### PROCLAMATION PROHIBITING THE KILLING OF CEDROS ISLAND DEER

Alvaro Obregon, Constitutional President of the United States of Mexico, considering that, owing to the excessive hunting of the deer *(Odocoileus cerroensis [cerrosensis])*, the species has greatly diminished on the island of Cedros, situated on the western coast of Lower California, of which reproduction is necessary in order that it does not become extinct, in exercising the power which is conceded to me in clause I of article 89 of the Federal Constitution, and with a basis of the articles 51 in the clause III of the law of the first of October of 1894 and 50 of the law of the twenty-first of December of 1909, I have held well to promulgate the following

### REGULATING ORDINANCES WHICH ESTABLISH THE PROHIBITION OF THE HUNTING OF THE DEER *(ODOCOILEUS CERROENSIS [CERROSENSIS])* ON THE ISLAND OF CEDROS.

Article 1.—It is prohibited for five years, beginning with the first day of June next, to hunt, capture, kill, or injure in any way whatever the deer *(Odocoileus cerroensis [cerrosensis])* on the island of Cedros, situated on the western coast of Lower California.

Article 2.—The prohibition includes the distribution or sale of the products originating in the animals referred to in the preceding article.

Article 3.—It will be considered as proof of the infraction of the foregoing article, the use of anything that alters the products of the deer, change of name, or the employment of any other means of deceit.

Article 4.—The violation of the preceding ordinances will be punished by a fine from $50.00 to $500.00, which not being paid, will be commuted to fifteen days imprisonment, and which will be imposed by the Bureau of Agriculture and Public Works or its Agent Generals.

Article 5.—The repetition will be punished by the penalty which, depending upon circumstances, should have been imposed for the last offence committed, with an addition to the fine:

1.—To one sixth part, if the offence shall be less than the former.
2.—To a quarter part, if both shall be of equal gravity.
3.—To one third part, if the last shall be more serious than the preceding.

4.—If the former fine shall have been remitted or the repetition shall not be the first, the amount may be double of that related to the previous infractions.

Article 6.—The act shall be considered a repetition when the culprit has been condemned on a former occasion for an offense of the same kind within the six months previous to the last.

Article 7.—For the imposition of the penalty, there will be considered as accomplices all the persons who by whatsoever means participate in the infractions of the ordinances contained in articles 1 to 3.

Article 8.—Because the Agent Generals of the Bureau of Agriculture and Public Works, imposes the penalties which are mentioned in the preceding articles, they will draw up the related report and transmit a copy of it to the said Bureau.

Article 9.—The fines which are imposed in accordance with the regulations contained in the foregoing articles, will be made effective for the management of the Federal Tax Office, exercising, on its part, the economic-co-operative power determined by the Fiscal Law.

Article 10.—In all cases of the imposition of penalties, the animals captured or killed shall be seized, also the weapons, ammunition, and hunting equipment which are found in the possession of the offenders.

Article 11.—If the animals seized be alive, they shall be returned to the place in which they were taken, and if they be dead, they shall be suitably disposed of. The weapons, ammunition, and equipment seized shall be disposed of by the said Federal Tax Office, except in the cases in which the Bureau of Agriculture and Public Works decides to use them.

Given in the palace of the Executive Federal Power in Mexico, on the seventeenth day of the month of May of one thousand nine hundred and twenty-three.—THE CONSTITUTIONAL PRESIDENT OF THE UNITED STATES OF MEXICO, A. OBREGON.—Published and executed.—THE UNDER SECRETARY OF AGRICULTURE AND PUBLIC WORKS, COMMISSIONER OF THE BUREAU, R. F. DE NEGRI.—Seal.

After lunch the ship was moved to the north end of the island where an extensive mining camp was once located. Three old buildings and the remnants of a wharf were still standing near the beach although they had not been utilized for about 25 years. Several burros greeted us upon our arrival. They apparently still had memories of their human associations.

Messrs. Tose and Hinkley worked up the cañon toward the old mine and, with the exercise of the greatest care succeded in getting only one bird, a Say's flycatcher. This is a fair commentary on the scarcity and wildness of the birds of Cedros. There must be a reason for this situation but, try as we would, we could not learn what it was.

Fishes were excessively abundant and several large jewfish were hooked at the anchorage.[19] Sardines formed a zone for half a mile out to sea. Mr. Anthony saw schools of yellow-tailed tuna 100 yards wide and half a mile long, and inshore numerous small "halibut" were caught "jumping" from the water. Out in a boat over the rocks and kelp gardens it was bewildering to watch the constant struggle for existence among the living things. When a tuna or barracuda entered the shoals of smaller fishes pandemonium reigned for several minutes. The sardines are preyed upon from below by many fishes and above by the birds. Their existence must be one adventure after another.

From the observations thus far made it appears that the greater part of Cedros Island is composed largely of Jurassic sediments—Franciscan cherts, sandstones, and in one place in Grand Cañon, conglomerate. Much alteration and metamorphism has taken place and from the excessive amount of fracturing it appears to be on or near a fault zone. At the southwestern corner of the island there has been some volcanism and at the north end the land is greatly disturbed with intrusions of serpentine. On the eastern side there are Pliocene sediments at one and probably two points.

On August 9 Messrs. Anthony, Slevin and I went up a cañon south of the landing to the top of Gill Peak, thence north down the mountain side through a pine forest to the old mine. From the top of the mountain we could see the western shore of the island with its extensive outlying kelp beds. This was the habitat of numerous sea otters about 100 years ago but if any are left they are very scarce. We saw none nor did we hear any reports of any. Except for the work we did later on the southwest side of the island the western shore is unexplored, biologically.

Extensive operations have been undertaken at the old mine. About 20 buildings and much of the machinery remain on the ground. The ore is a white rock said to have been rather rich in copper and gold. Large quantities were shipped from the mine to San Diego for smelting but this form of operation did not pay. We could not investigate the underground workings

[19] See Nat. Geog. Mag., Vol. 44, No. 1, July, 1923, p. 83.

because of caving at the entrance. The ore on the dump was leached and the stream bed below was blue green in color. In operation the ore was hauled in carts down the steep cañon bottom to the wharf. A cobblestone road was built in the creek bed at great expense but it has almost completely washed out. Pipe lines are mostly rusted out and the entire plant is in an advanced state of decay. A visit to such a place makes one sad to think of the great amount of toil and money used and hardship endured for naught. It is a graveyard of human effort.

Messrs. Tose and Hinkley saw four more deer during the day but did not take any of them. On our trip to Gill Peak we saw only abundant signs of the animals. During this entire trip of about seven hours' duration we saw four land birds and four only. These were three wrens and a shrike.

Late in the evening Mr. Anthony and I visited the sea-lion rookery at the north end and estimated the number of animals at approximately 1000. Harems had completely broken up and the herd was hauled on the beaches away from the rookery ground. We wanted to be sure no fur seals had hauled out here near the sea lions. On the way back we were greatly impressed by the inconceivable numbers of fishes in these clear waters.

On the morning of August 10 Messrs. Tose and Hinkley returned to the ship after a cold night spent sleeping in the hills. They wanted to be out late in the evening and at daylight in the morning in hopes of securing specimens which otherwise are unobtainable, particularly birds, but little success attended their commendable efforts. They did bring back another male deer.

At seven-thirty a. m. we left the mine anchorage and returned again to Bernstein's camp. His launch, the *Marian,* had been there the day before and left supplies for the *Tecate.* At anchor we found the auxiliary schooner, *Gipsy Girl,* from San Pedro, California, with Captain Farnsworth, Mr. Peabody and Dr. Spencer on board.

We left the anchorage the same day and stopped for the night at the west end of South Bay, too late to explore much.

Traps were put out, however, and next morning, August 11, they contained six Peromyscus and one Perognathus. At six a. m. we sailed around the southwest corner of Cedros to the abalone collecting station maintained by Bernstein Brothers. The station is on the southwest peninsula in the protection of some off shore projections called "Red Rocks."

Messrs. Tose, Hinkley and Slevin went ashore collecting at eight a. m. After tramping all day and until five p. m. that evening, the ornithologists came back with the news that they had found a skull of an elephant seal on the beach. This was an interesting record as it showed something of the former distribution of the species. After nine hours of search the same men saw only one land bird, a wren. Mr. Slevin took 57 lizards representing only two species. Messrs. Cuesta-Terron, Gonzales, Angulo, Anthony and I visited the abalone divers at work in the kelp and examined the red rocks at close range. The outer one had 50, the inner 250 California sea lions, but no fur seals. Both islands are low and the surf breaks over them in storms.

One of the men at the camp had killed a female deer that morning and he gave us the skin and skull. He also gave us two other skins, a pair of fine buck horns and a good skull of a porpoise.

We ate lunch on shore at the camp and at two p. m. I went down in one of the diver's outfits in 24 feet of water. It was the most marvelous sight I have ever seen. The sensation experienced of moving about among the fishes, the star fishes, the anemones and the giant swaying fronds of seaweed is indescribable. Purple coraline algæ covers much of the rocky bottom at this point and against it as a background the golden garibaldis looked like gems. Many other fishes swam about and inspected me from all angles. It was rather disconcerting to have them stare into the helmet at me. Abalones were very common but they carried so many other things about, growing commensually on their shells, that they were difficult to see at first. The diver in operation prys them loose with a bar and puts them in an iron basket to be hauled to the surface. These men stay down for four hours at a time but I found it very fatiguing after a few minutes.

The country in the vicinity of this camp is exceedingly barren and dry.[20] There is very little vegetation of any kind. One of the men told us there was a third giant cactus tree on the west side of Cedros Mountain in addition to the two found by Mr. Slevin and me on the south side. This may be of interest to botanists because the species would very likely be overlooked on casual inspection of the island, yet it is a definite resident. The two individuals we examined were about 15 feet high.

During our stay on Cedros Island we did not see any of the dogs which are said to have gone wild on the island. Cats are said also to be found in the hills, and the people at Bernstein's main camp had a gentle young kitten which they said had come to them two months previously.

At seven a. m. of August 12 we left the abalone station at Red Rocks after taking up the traps and the six wild mice they contained. The ship was taken to the harbor on West Benito Island, where we went ashore at nine-thirty a. m. Messrs. Cuesta-Terron, Anthony and I spent the rest of the forenoon surveying the shores for fur seals but we found none. It has been reported that these animals may have been on the San Benito Islands since they were exterminated on Guadalupe. Mr. Rufus A. Coleman, a member of the California Academy of Sciences, visited West Benito in 1916 with the steamer *Albatross* and saw some animals which he thought possibly may have been fur seals. We found only about 150 California sea lions on the rookery ground.

On the beach opposite the landing we found many bones of elephant seals and four fairly good skulls were saved. Our cook on the *Tecate* stated that he was on West Benito six months in 1918 in a lobster camp and saw two elephant seals on the same beach. About the same time six were found on the southeast corner of East Benito, one of which he shot. The islands were probably used only for a hauling ground and the presence of these remains here, on Cedros Island, and the animals found in 1888 at San Cristobal Bay, may furnish a clue as to the migration of the species from Guadalupe. Miss M. E. McLellan has called attention to the belief of some naturalists[21]

[20] See figure in Nat. Geog. Magazine, Vol. 44, No. 1, July, 1923, p. 90.
[21] See Anthony, Journ. Mammalogy, Vol. 5, No. 3, 1924, p. 149.

that the elephant seal of Chile and Guadalupe are one and the same species. While statements of Harris and Rothschild[22] cannot as yet be definitely disproved it is doubtful if the northern animal can cross the equator twice each year and still be where the records show it to have been on certain dates. The two groups may be the same species but I doubt if they are part of the same herd and if they ever associate together.

The afternoon of August 12 was spent in general collecting. Least, black and Soccoro petrels were taken from burrows and in rock slides. (See pl. 17, fig. 3.) Some fresh eggs were found. A specimen of McGregor's house finch, confined to the San Benitos, was one of the very desirable species of birds taken. San Benito sparrows were common.

Land shells *(Micrarionta pandoræ)* were living in abundance in the rock slides and a sufficient number was taken to study the excessive variation of the species.

House cats have gone wild on this island as on most of the others visited.

On West Benito there was a camp for the collection and drying of abalones; it was owned by a Japanese who had a concession for the work. Large quantities of "meats" were on the frames drying and the methods employed were essentially the same as those already described. All fuel and freshwater has to be brought from San Diego as there is none of either on the San Benitos.[23]

No signs of mice or rats were seen on West Benito Island but lizards belonging to one species were common.

In the early morning light of August 13 Messrs. Slevin, Anthony and I rowed to Middle Benito Island for two hours' collecting. No land shells were found but many desirable beetles were collected. San Benito sparrows and a duck hawk were collected. Least, Socorro and black petrels and western gulls nest on the island. Cats are apparently very abundant if we may judge by the remains of petrels about the burrows. A great many elephant seals and sea lions have been killed on the

[22] Rothschild, Notes on Sea Elephants (Novitates Zoologicæ, Vol. 17, 1910, pp. 445. 446).

[23] See figure in Nat. Geog. Magazine, Vol. 44, No. 1, July, 1923, p. 94.

island in the past; their bones were abundant. Many bones of whales also were seen.

No mice or rats were found on the island but there were small lizards belonging to the genus Uta.

After breakfast the ship was moved to East Benito and 4½ hours were spent in shore collecting. Land shells of the Micrarionta group were abundant and I found another species belonging to the family Pupillidæ not previously known from the islands. It was found only in one rock pile on the east side of the island.

San Benito sparrows were collected and I took a mummified hermit thrush from the thorns of a "cholla." One house finch was seen. That species is now practicaly extinct and it is somewhat doubtful if any other field collector will ever see it alive. If the absence of the birds was due to migration then the distinctness of the form might well be questioned. Pelicans nest on the east side of the island and Brandt's cormorants on the west.

About 1,000 California sea lions were found on the east side in the "fiords." Mr. Slevin took lizards belonging to the genus Uta on this island. On East Benito Island I had the interesting experience of being stung on the knee by a scorpion, and thus an opportunity was afforded to test the "deadliness" of this arachnid. The sensation was about that of being stung by a honey bee but the pain did not last as long. A slight but temporary swelling resulted and the spot was red for perhaps a week. An hour after the sting the wound would never have been noticed except for a slight itching which was noticeable for fully a month afterwards.

There is some evidence of house mice on East Benito; many small land shells were broken open in a manner similar to those on Guadalupe, the work there having been attributed to the mice. Cats were also abundant on East Benito and they were wreaking havoc among the petrels.

The three San Benito Islands are small and close together in an east-west line. The westernmost one is about 661 feet high and is composed largely of Franciscan chert of Jurassic age, beautifully contorted and laminated. There has been some

metamorphism of the sediments on the south side.[24] The Middle Island, the smallest of the three, is composed entirely of chert. East Benito is high and rugged and largely metamorphic. Schist, marble and quartz are abundant rocks. Only the tops of the three conspicuous hills disclose the Franciscan chert formation. All of the islands show the Pleistocene submergence and subsequent uplift. They were not down long because the sediments deposited are very superficial. The eastern island seems to have been down the shortest time and the fiord formation of the shore line indicates that it was not elevated to the original level again.

Most of the available shore lines of the islands were occupied by California sea lions.[24]

We left East Benito Island at two p. m. for San Quintin Bay. A brisk northerly wind and heavy swell held us back all afternoon and the following night.

We arrived at San Quintin at noon of August 14 and hurriedly took on fuel. This being completed at two-thirty p. m. we left at once for San Martin Island, near the entrance of the bay. It was five-thirty p. m. before we were safely anchored but all of the party hurried ashore to collect as much as possible before darkness overtook us.

The main part of the island is volcanic, and densely covered with cactus, brush and huge blocks of lava. Caves and blowholes are everywhere and at the top there is a crater.

Several species of plants are found only on this island, one being a magnificent Dudleya waist high.

The deep cavities and crevices are occupied by numerous woodrats with black feet. The Japanese in the past have attempted to destroy these rodents, first by introducing cats then by burning the brush systematically but neither course proved effective. The cats appear to live on birds and beach débris.

A frame house in good condition was formerly occupied by a Japanese abalone camp but was empty at the time of our visit. Net racks close by were being used by the purse seiners to repair their fishing gear. Three of their boats anchored in the little cove where we were for the night. They were manned by Austrians.

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[24] See figures in Nat. Geog. Mag., Vol. 44, No. 1, July, 1923, pp. 86, 87.

I succeeded in finding four or five species of land snails on the island and Mr. Tose collected a rock wren, which has been described as a distinct subspecies.

A snake was seen among the great lava blocks but it could not be captured, much to the regret of Mr. Slevin; no species had ever been collected on San Martin.

At seven p. m. the boats were hoisted and we sailed for Ensenada. This we reached at nine a. m. of August 15. The day in port was largely spent in packing collections and equipment and making general preparations to disembark next day at San Diego. This we did at nine a. m. when the expedition came to its logical end.